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modern plastics

FEBRUARY 1941

VOLUME 18 NUMBER 6

MARCH

Complete plastic dentures—teeth and plates—as well as crowns, bridges and even fillings constructed of acrylic material instead of porcelain, are a late development in dentistry which Dr. E. Byron Kelly, specialist in prosthodontia, discusses in the March issue.

Another feature next month will be a description of a new resin-impregnated stretchable paper which may be molded without the addition of any further resin, since it flows within the mold, or which may be used as filler, core stock or laminating material.

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• TECHNICAL SECTION

• NEWS AND FEATURES

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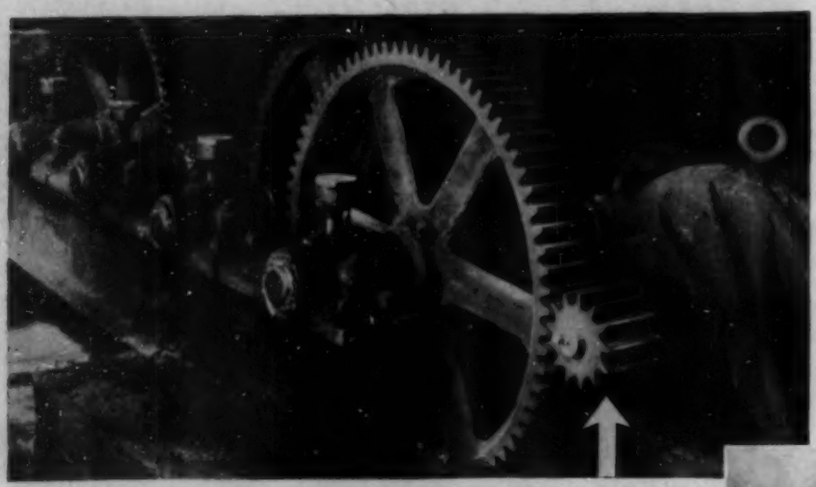
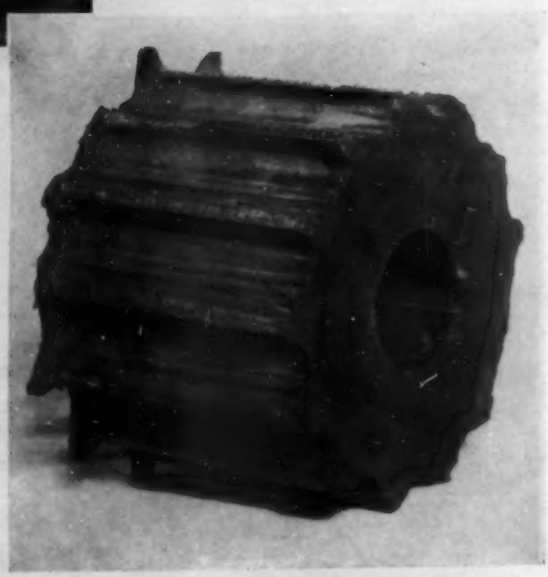
BETTER THAN Wears like IRON!

This age-old comparison lost its meaning with the introduction of INSUROK, the amazingly durable plastic that actually outwears metal many times over. For example: this laminated INSUROK pinion, driving a sand-blast machine, wore almost TWELVE TIMES LONGER than the finest metal pinion previously used, and outlasted FOUR mating gears. Subjected to a continuous storm of sharp-cutting sand, this INSUROK pinion was still in operation after six years, despite the fact that its teeth had worn down almost to the root diameter. It was, naturally, replaced by another INSUROK pinion. Yet this, and numerous other instances of extra service and longevity of Laminated INSUROK are commonplace performance.



INSUROK

is not limited, however, to gears such as the sand-blast pinion illustrated. INSUROK offers industry an unexcelled plastic of almost limitless versatility for use in hundreds of products as well as in mechanical equipment. Learn about INSUROK and its application to your needs. At your service, without obligation, are the facilities of Richardson Research, Design and Engineering Laboratories. Details on request.



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MODERN PLASTICS
WILLIAM T. CRUSE, Editor

FEBRUARY 1941 VOLUME 18 NUMBER 6

Twentieth century ice boxes

by CHARLES LICHTENBERG*

Odorless, tasteless, dimensionally stable, molded polystyrene is well adapted for interior refrigerator applications

IN the early nineteen twenties, the household electric refrigerator was a curiosity to be seen only in the model homes so commonly erected in conjunction with real estate developments. But it wasn't long until ice-less refrigerators were in actual service in thousands of homes throughout the country. During the following decade the convenience, reliability and economy of mechanical refrigeration were so widely accepted that refrigeration manufacture blossomed into a full-fledged industry, with the large and efficient organizations that characterize American initiative and industrial enterprise. Today this industry is among the leaders in progressive manufacturing methods aimed to provide continuously the best possible product at the lowest possible price.

During the first years, the attention of refrigerator engineers was devoted almost exclusively to the means of providing efficient and reliable mechanical systems. The problems involved were many and complex, but by dint of well-planned research, courageous engineering and specially developed manufacturing methods, these problems were successfully dealt with. Simpler and more efficient compressors were evolved; more rugged controls were developed, and better refrigerants worked out. Then, without relaxing in any degree the effort put behind research in the mechanics of refrigeration, greater attention was given to making the box more convenient to use, more beautiful, and more fitting as a part of modern home kitchens.

The first refrigerator cabinets were essentially adaptations of ice boxes, but it soon became apparent that these were not suited for mechanical refrigeration. To meet the need, the metal-framed, insulated cabinet with porcelain or synthetic enamel finish was developed. As the industry progressed, this basic design was con-

* Monsanto Chemical Company

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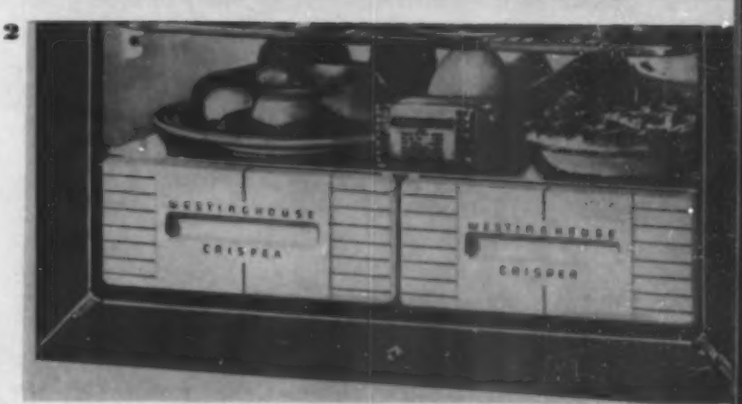

1—Polystyrene panels for the evaporator and crisper doors in this Westinghouse refrigerator interior are stable to the cold atmosphere and lend color and style. 2—Close-up shows cream-colored polystyrene crisper drawers on another recent model

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3—The 200 sq. in. projected area of the Philco cold unit door frame necessitates material being injected from 4 separately controlled heating synchronized tunnels. Varying conditions of molding require individual adjustments of quantity of material, temperature and pressure. 4—Molded door frame with die cast doors in place

tinuously refined. Plastics first made their appearance in electric refrigerator cabinets over ten years ago in the form of laminated phenolic breaker strips that seal the door and improve eye-appeal. These are still used and from time to time, various small molded parts such as switches, controllers, etc., were added.

Then, less than three years ago, the plastics industry took a step that was to have an important effect on refrigerator design. Polystyrene was introduced as a plastic molding material. As the many unusual properties of this new material became known, it was apparent that polystyrene was excellently suited in many respects for use in electric refrigerators. Progress in applying these advantages for better-looking and more efficient designs came quickly. As a result of extensive development work both by material suppliers and refrigerator manufacturers, this year polystyrene molded parts are used on a majority of the new models.

Sound reasons underlie the rapidly expanding use of polystyrene in electric refrigerators. Notable among these is the tendency of polystyrene to become stronger and tougher as the temperature goes down. Fig. 8 shows the extent of this temperature-strength effect, significant in interior refrigerator parts subjected to continuous cold of 0 deg F. to 50 deg F. In the case of certain other thermoplastics, embrittlement occurs at lower temperatures. In parts such as the Philco evaporator door which is described later, any such embrittlement would make impossible the use of a plastic. Since polystyrene gets stronger as temperatures go down, however, this material is ideally suited.

Molded polystyrene is noted for high dimensional stability and consequent freedom from warpage. In general, warpage of a part molded of any plastic is due to three things—water absorption, high coefficient of expansion, loss of plasticizer. To varying degrees, most plastics tend to absorb moisture in humid conditions and release it when dried. As humidity conditions change, the amount of water held by the material varies, changing the size and shape of the part by setting up uneven stresses. Polystyrene has extremely low water absorption. As a result, warpage of polystyrene molded parts from this factor is obviated. Another factor affecting warpage is the coefficient of expansion. As temperatures change, materials expand or contract. In some materials this expansion and contraction is so

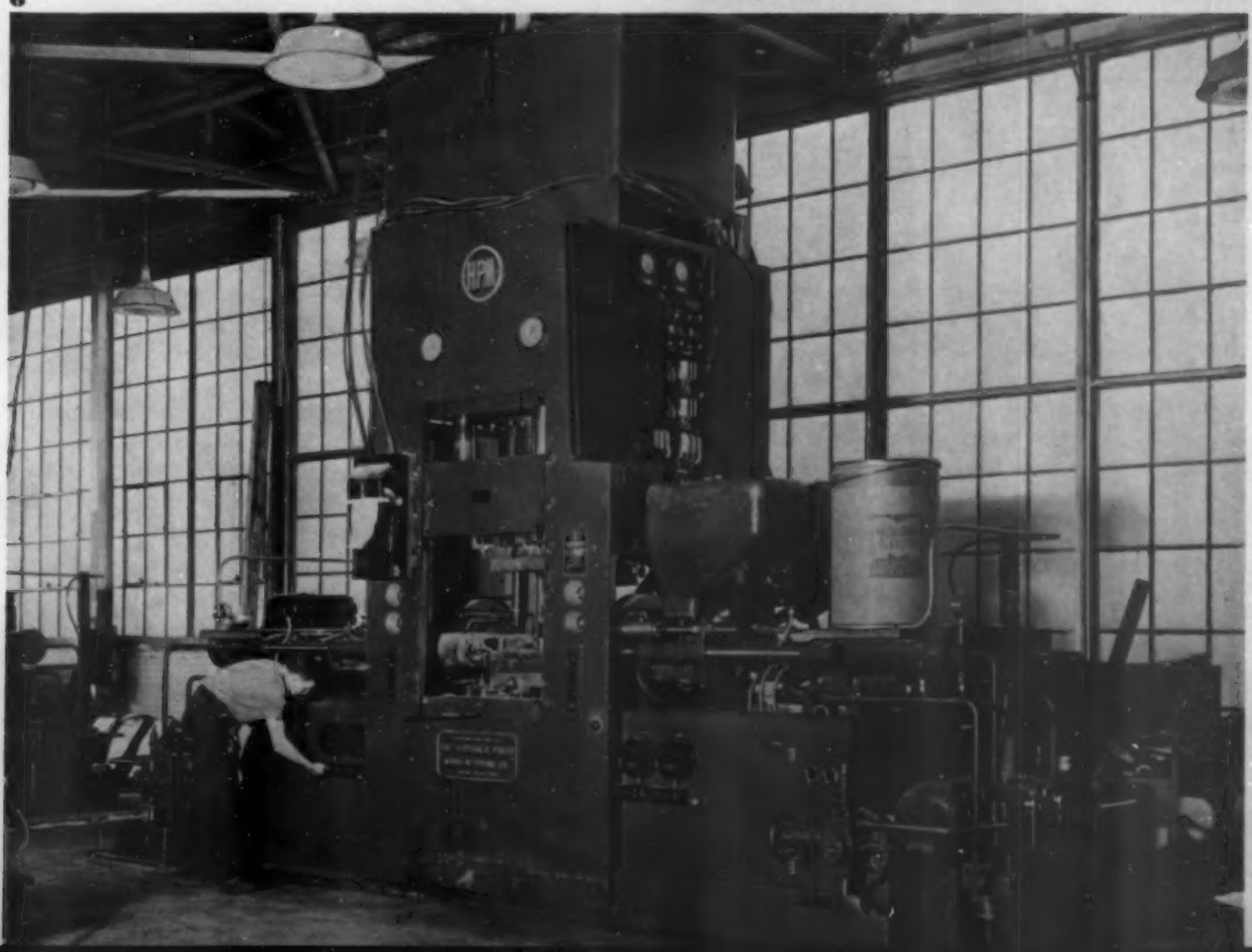
great as to set up strong strains in the material. Compared to other thermoplastics, the coefficient of expansion of polystyrene is low, and as a result does not cause warpage. Furthermore polystyrene, unlike most other thermoplastics, contains no plasticizer. Therefore, there is no shrinkage of molded parts from plasticizer leaving the material over a period of time. As a result of these three factors, the dimensional stability of polystyrene is exceptionally high. While not important in refrigerator design, it is noteworthy that polystyrene has a heat distortion point higher than some other thermoplastics (around 80 deg. C.).

In normal use, refrigerator parts are likely to come in contact with such materials as food acids, alcohol and cleansing materials. Polystyrene is resistant to such reagents. The acid resistance of styrene is dramatically illustrated by its use in acid-lead type battery jars, where the styrene comes in direct contact with sulfuric acid. In the case of the somewhat weaker acids found in tomato juice, vinegar and citrus fruit juices, it is likewise unaffected, a fact demonstrated by tests carried out continually over a (*Please turn to page 78*)

5

5—Two injection chambers are required for molding this transparent polystyrene Philco evaporator door. While two tunnels are necessary, through engineering, the material flows to the door in the die at only one point when the mold is closed. 6—This 500-ton multiple-cylinder injection molding press is used to produce some of the large thermoplastic castings which are pictured throughout this article

6



U. S. Navy plastics program

The Navy is actively exploring all types of plastics. Cooperation and support of material suppliers and molders are welcomed

PROBABLY no department of the Federal Government has had more experience with plastics than the Navy. They have used thermosetting materials in many ways for different purposes on surface and undersea ships for many years. The extensive and recent use of transparent types in airplanes is well known. The Navy feels it has only begun to develop the potential possibilities of plastics. While their performance in service has been generally successful some failures are acknowledged and certain limitations are recognized. The Standards Branch of the Bureau of Ships of the U. S. Navy whose duties include among other things, the investigation and examination of all classes of materials are at this time aggressively exploring the potentialities of applying plastics beyond those places where they are now used as a matter of standard practice. In this program they are encouraging the active cooperation of raw material manufacturers and molders. It is felt that through the participating efforts of the laboratory and manufacturing branches of these organizations a great deal can be accomplished. As an example, through this approach the U. S. Navy Bureau of Engineering Specification No. 17 P 4, covering phenolic material, molded, was established. It is estimated that it has controlled, since it was adopted, the annual purchase of more than $3,000,000 worth of plastic materials.

Perhaps no section of applied plastics required nor received a more comprehensive scientific investigation than that accorded laminated phenolics. It is doubtful if there exists elsewhere a more exhaustive detailed compilation of comparative data on laminates than has been prepared and assembled by the Bureau (Navy Specification No. 17 P 5).

Plastics which have recently come in for intensive study by the Standards Branch of the Bureau of Ships have been the ones which are suitable for electrical illumination and light transmission applications. The final specification has not been established. The ad interim specification (Navy Specification No. 17 P 8) has been prepared. As drafted this specification will involve plastic synthetic resinous materials classified as follows:

Type C. Clear vision.
Type D. Diffused illumination.
Type O. Opalescent or translucent.
Type T. Tinted or colored.

These materials are to be supplied for test, as required, in the form of either molded shapes, rods and bars or as sheets and plates. The specifications designate the form.

The clear vision material shall have a refractive index of 1.50. It shall transmit when new not less than 85 per cent white light. After 6 months weathering it shall transmit not less than 80 percent white light. It shall be suitable for use in connection with instruments, gages and dials where clear glass is ordinarily used.

The diffusion material is to be suitable in every respect for use in electric lighting fixtures and similar applications where the light emanating from a small high intensity source requires dispersion.

In general the opalescent or translucent material shall meet the same requirements as for diffusion materials. Tinted materials shall be suitable for use in electric light fixtures where color is significant such as indicating and color marking systems.

In considering the broadening possibilities of plastics the Bureau is adopting the same objective approach which has successfully guided its consideration of the wares of other industries, such as electric motors and insulation varnishes. The conditions which govern Navy tests as conducted in the laboratories are broad. As outlined in a Department memorandum, tests are made for the following purposes:

A. To establish and maintain an acceptable list of approved materials.
B. To determine compliance with the requirements of existing specifications and the suitability for naval use, of machinery, apparatus and materials under contract, when there is no acceptable list, or a product is not on the acceptable list; or, when an alternate to the specifications has been submitted.
C. To develop specifications for naval use.
D. To develop machinery, apparatus, materials or designs for naval use to fill a critical need.
E. To conduct research on new machinery apparatus and materials where naval need for such machinery, apparatus and materials is critical.

Two important considerations which are and have been a part of the Navy's application of plastics are, in so far as it is feasible, a good geographical distribution of its molded and laminated parts sources and secondly, encouraging the plants to install their own testing equipment. One specification (No. 17 P 4) devotes section (H-3b) to this recommendation. It suggests "Know by Test." It is just as important, from

the molders own viewpoint that he should be in a position to know, by his own tests, the actual character of his own product. Unless he is provided with proper test facilities he cannot know in advance whether or not he can attain the quality of material contemplated by the specification; nor if even once accomplished by careful supervision of the preparation of the standard "qualification test" specimens, whether he can expect to attain the same standard in his subsequent production moldings under contract; neither can he determine just when, in what direction, or how far he deviates from the fixed standards of the "approved sample." Without such direct knowledge of his product he is unable to maintain any semblance of that "manufacturing control of quality" which is so essential in the maintenance or improvement of material standards."

The tests as set up do not require elaborate nor expensive equipment. Molding plants to be approved as U. S. Navy suppliers must submit test specimens. The conditions for this procedure and an outline of the test pieces required are included in Bureau of Engineering specification 17 P 4. The test specimens in many respects follow those of the American Society for Testing Materials.

Ships of the U. S. Navy are not built to look pretty when they ride at anchor in the Hudson or San Francisco Bay or elsewhere. They are constructed to perform and perform successfully when called upon. As the world reckons today, allowances cannot be made for either time or place. Whether it will be in the frigid Behring Straits or somewhere under the Southern Cross or in the blistering sun of the Yellow Sea the charts do not show. One predetermined fact exists, one unequivocal axiom prevails, there can be no failure. When called upon, materials as well as men must "come through." After all, every design every specification, every test, every part and piece is planned to stand the critical ordeal of action.

No one is more alive, nor more alert to the vital necessity of treating with the materials problem, with these conditions in mind, than the Standards Branch of the Bureau of Ships. If one gains any impression from dealing with them it is that they have a "must" philosophy which revolves around two axes—must be done and must not fail.

An idea of their "step by step" approach toward plastics as well as other materials problems, may be gained from Mr. J. B. Lunsford* of the Standards Branch, Bureau of Ships who has summarized the program in this manner, "What we think important today, as a detail, may not work out, and so tomorrow we may drop it. If we were sure, now, there would be no use of experimenting. (*Please turn to page 82*)

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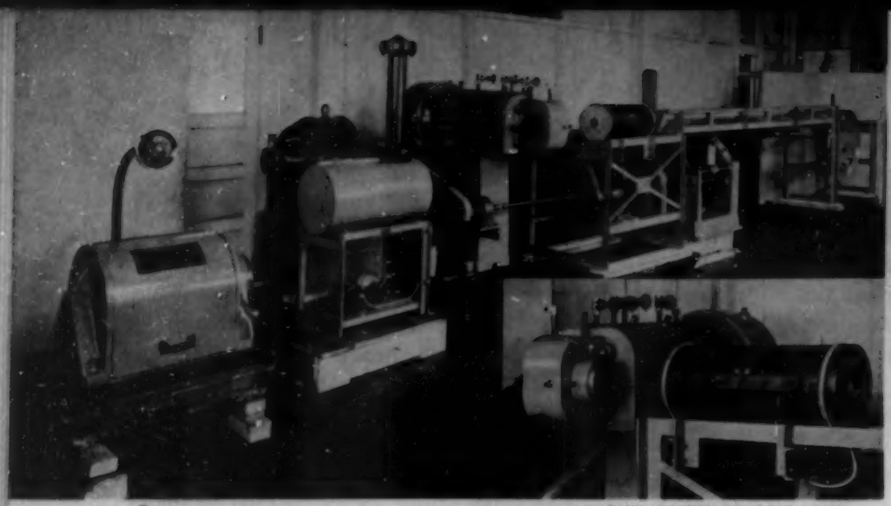
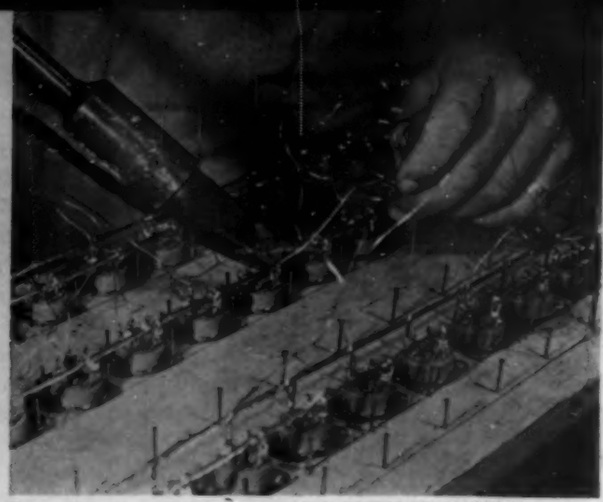
* J. B. Lunsford, Standards Branch, Bureau of Ships, Navy Department, Washington, D. C., from Journal of the American Society of Naval Engineers.
Copies of the Specifications referred to herein are available through the Bureau of Ships, Navy Department, Washington, D. C.

These speedy versatile U. S. Navy "P.T." boats equipped with anti-aircraft guns and with torpedos, rely on plastics in strategic places for certain motor parts, electrical insulation and for important circuit controls

OFFICIAL PHOTOGRAPH, U. S. NAVY



1 PHOTO, COURTESY JOHN ROYLE & SONS



2 PHOTO, COURTESY DOUGLAS LEIGH, INC.

Synthetic wire coverings

by A. O. BLADES*

COMPARATIVELY recent, the application of plastics for wire coverings in the electrical industry bids fair to develop with rapid progress for the same reasons that account for the present widespread popularity of molded plastic parts now used in that field. Wire coverings and molded materials are alike only in their ultimate purpose—electrical insulation. Formulation, processing, and service requirements differ as will be explained. Further than this, the actual number of useful plastic materials now available for wire coverings are relatively few so that for the present, selection of the proper synthetic resin is a less difficult problem than for molded insulation.

The most common type of wire covering is rubber. Due to the rubber-like characteristics of most plastic wire coverings, it is naturally a first consideration to apply these materials as rubber substitutes wherever there is an advantage to be gained. Experience has indicated that this advantage will be mainly one of performance and is due to certain inherent properties of the plastic resin itself. The increased cost of synthetics can only be justified on the basis of better and longer service since the present synthetic materials used as wire coverings vary from 2 to 10 times the cost of the rubber compound they replace. Good dielectric properties are not enough for the usual type of wire insulation. Dependent upon service conditions and the particular product classification involved, wire coverings must exhibit a long useful life under extremes of heat and cold, in sunlight and weather, under exposure to ozone, oxidation, oils, solvents and chemical vapors. Some cables are permanently immersed in salt and fresh water, subjected to extremes of flexing and abrasion or installed underground in acid and alkali soils. As with molded plastics, there is no one material that excels in every requirement. Research has indicated, however, that by proper selection and application it has been possible to obtain well balanced properties to cope with these service conditions.

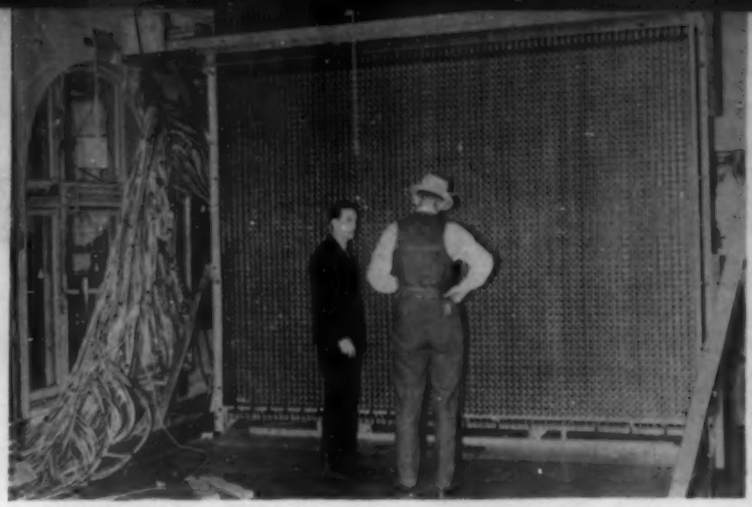
The development of synthetics for wire coverings has been so recent that their characteristics and suitability for service has necessarily been determined by extensive testing in lieu of actual experience. Partly for this same reason, the use of these new materials by themselves is being confined to low voltage (0–600 volts) power, signal and control cables, since operating hazards rapidly increase with higher voltage cable. It is probable that after a reasonable length of adequate service the permissible operating range will be gradually extended for those materials that exhibit promising electrical characteristics.

Cable coverings are divided into two general classifications as follows: (1) *Insulation:* This covering must provide the necessary electrical insulation to the cable conductor and may or may not provide the complete physical protection. (2) *Jacket:* This covering is applied over the insulation for the sole purpose of obtaining the desired physical protection of the insulation. Jackets may have but usually do not possess good electrical insulating value.

Insulations

By far the most widely used synthetic for wire insulation involves *vinyl resin* either as a copolymer of vinyl chloride and vinyl acetate or a straight polyvinyl chloride. These wires are now available in a wide range of sizes and distinctive colors.

* General Research Labs., General Cable Corp.



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1—Complete layout of equipment for insulating wire and cable with plastic coating. Wire passes from reel through insulating machine head, high annealing furnace, water-cooling spray trough, wiper pad and around capstan to take-up reels. Insert shows extruder close-up. 2—Insulated lead wires are being soldered on a section of the control board. (3) of a huge electric outdoor advertising sign. 4—Part of 600,000 ft. of plastic coated insulated wire used. 5—Exterior view of the Wilson Whiskey sign as it appears on New York's "Great White Way"

A typical insulating compound of this type is as follows:

Vinyl Copolymer	100
White Lead	3
Calcium Stearate	2
Carbon Black	2
Whiting	20
Tricresyl Phosphate	60
	187

In this compound the white lead is used as a stabilizer to inhibit the formation of hydrochloric acid under adverse conditions. The calcium stearate acts as a lubricant during processing. The whiting is used as an extender and lessens cold flow. Wire compounds are more highly plasticized than usual molding compounds, as the amount of tricresyl phosphate indicates.

In mixing such a stock the dry ingredients are first blended, plasticizer added and if desired, a small amount of acetone is added to assist in softening the resin. This mixture is allowed to stand 24 hrs. and the batch then mixed either in an internal mixer or on open rubber rolls using a fairly close clearance. The compound can be extruded with the conventional rubber tuber, given proper temperatures and controls. More uniform and better results can be obtained using one of the special thermoplastic extruders now on the market. (Fig. 1) These have a relatively longer barrel and usually a single thread screw. This allows the stock more time in the machine and is necessary because the extrusion temperature is much higher than that of rubber.

As the insulated wire leaves the tuber it is passed through an annealing tube at a temperature of 600–900 deg. F. This tends to remove internal strains incident to tubing and flows the surface slightly, imparting a higher gloss. From the annealer it is chilled in a water bath and taken up on a reel, ready for testing.

The use of vinyl compounds for wire insulation has been greatly increased by their recent application to a new type of small diameter building wire now recognized by the National Electric Code and designated as type *SN*. By substituting this wire for the conventional rubber-braid covering (type R) the corresponding reduction in overall diameter permits between 2 and 3 times the previous copper area to be used within the original conduit. This feature, together with the fact that SN wire is rated for operation at a 10 deg. C. higher temperature than type R means that increased loads due to modern lighting and appliances are adequately provided for by merely *rewiring* with SN. Thus, the costly and laborious expedient of tearing out floors and walls to install new conduit space is eliminated by a simple, yet very practical and effective rewiring job.

A field of recent growth is in switchboard and control wiring. The control panel (Fig. 5) of a huge advertising sign[1] which operates on a new principle, the patents for which are held by the firm (*Please turn to page 84*)

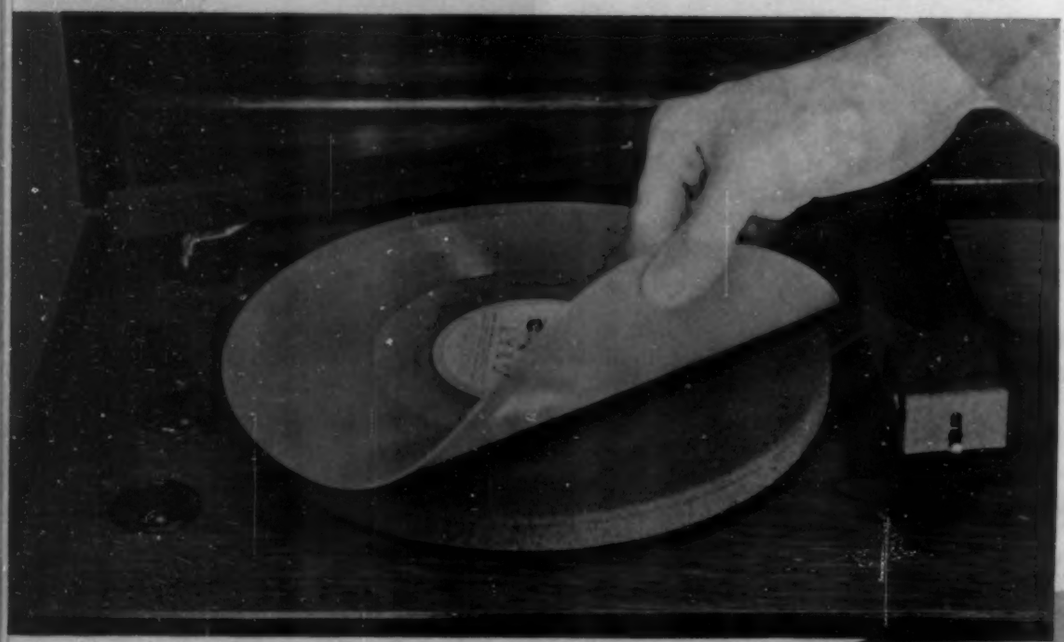
[1] See Modern Plastics, December 1940, page 40.

Molded modulation recordings

A new economical process speeds production of plastic phonograph records

PURCHASES of phonograph records during the last few years seem to indicate that the phonograph is staging a winning comeback. Not that the phonograph was ever out of the running, but for a few years, radio was giving the "master's voice" some stiff competition. Sound recording as a science and as an art is still in its infancy, but along with the progress that is being made, we find plastics walking hand in hand with the startling new successes in this field.

One of the most sensational developments to affect the phonograph world in recent years is the introduction of a plastic record produced by a new process with a minimum of time and expense. The duplicating process, which eliminates much of the present-day equipment, is said to be superior to the older method of making records not only in the manufacturing processes employed, but in the production of a final record equal to the very best recordings made today. This new



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1—These phonograph records are lightweight, flexible and practically impossible to break. Because they can be made very thin, the storage problem in record libraries is reduced to a minimum. 2—In the order in which the disks are used to make a final recording: the aluminum original, the phenolic stamper and the pressed thermoplastic

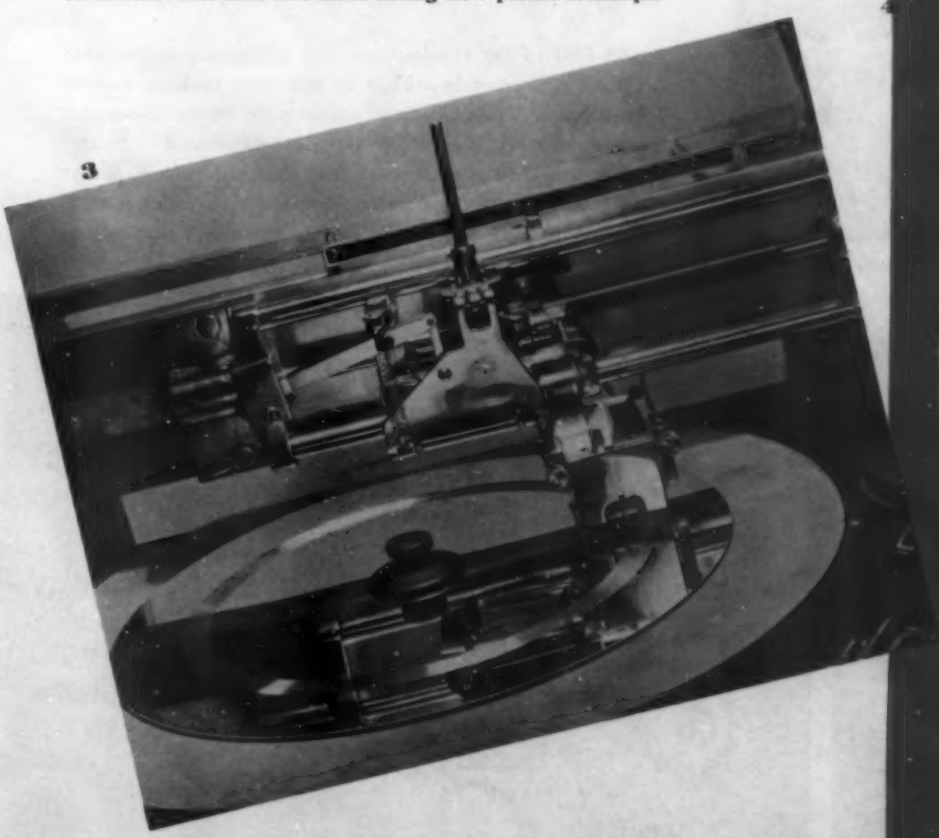
process eliminates all of the plating equipment and plating labor now required in most methods of record making, thus saving space, time, labor and money.

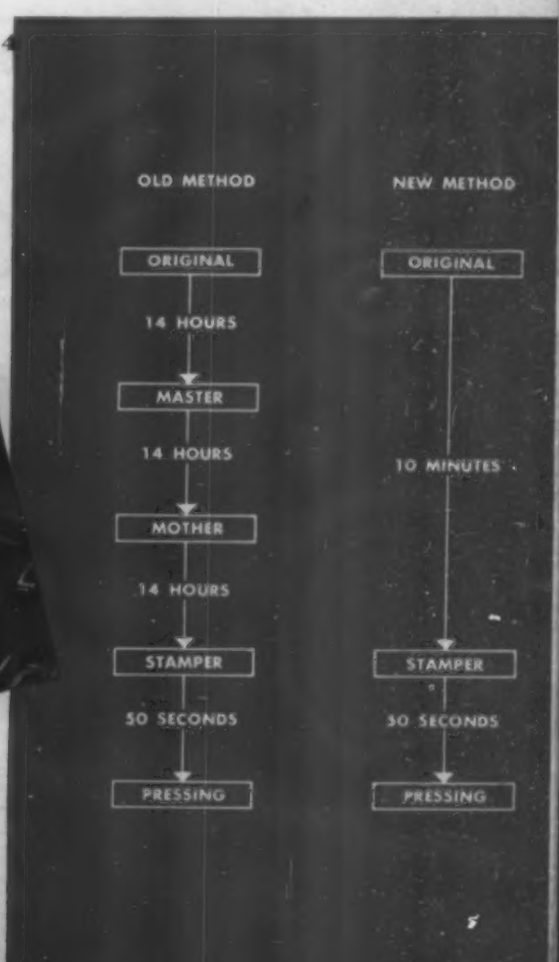
The usual method of making pressed record duplicates of an original recording is first to record on wax or nitrate coated aluminum disks by cutting. Then a negative of the original record is made by electroplating the recorded surface. This operation requires not only preliminary treatment of the original disk, but also 10 to 20 hours of plating time. This metal negative containing the reverse of the original recording is then used to mold phonograph records in acetate, vinyl or shellac composition materials. If large quantities of pressed records are required, the first negative is not used for stamping the final records, but is then replated to get back to the original in metal and this metal of the original is then again plated to produce a metal negative for stamping. Where large quantities of records are made numerous stampers are required, but it is possible to obtain only one stamper from the original record as the surface is ruined in the process. Thus we see the necessity of retaining the first metal negative which is the only permanent copy of the original recording.

In this new method, the process is not only much cheaper and far quicker, but it permits the original record to be "played back" immediately after recording, so that any fault in the original recording may be detected at once, and a new record made if necessary. The original record in the new process is not made in soft wax, but rather in metal; sheet aluminum approximately $^1/_{16}$ inch thick may be used, but for best results a special metal surface is employed. The cutting of an original which requires care and skill in operating the recording apparatus and special handling of the waxes in the old method is entirely eliminated, being replaced by a simple embossing process. After the recording on the metal disk, the record is "played back" and if found satisfactory, the engraved record is cleaned and placed into a hydraulic press to serve as a mold for making a negative record out of some thermosetting plastic material, preferably a phenolic. Eight or 10 sheets of phenolic impregnated paper are generally used. This operation requires about 10 minutes of press time as compared to hours of plating time to produce the first negative by the other method. Another advantage lies in the fact that the original recording is not damaged in the process and as many negatives as are needed can be made directly from this original. An interesting sidelight pointed out by the manufacturer relates to the sensitivity of the metal disk and the phenolic in the molding process. If there is the slightest mark on the metal plate—other than the recording, of course—even so much as a finger print, this will appear on the phenolic plate and on the finished pressing.

The final record is formed by the third step of the process. In this instance, the phenolic record is removed from the press and (*Continued on page 88*)

3—Aluminum disk rotates under a diamond stylus to make the original recording. 4—Chart shows the various steps required in making a phonograph record by the old method contrasted with time and labor-saving new plastic technique





Self-service on the avenue

Acrylic plastics prove their functional value in an unobtrusive but decorative way

JUST a few doors up from one of the busiest corners in the world—New York's 42nd Street and Fifth Avenue—is a new cafeteria. This is not the usual order of things, for cafeterias are not generally found hobnobbing with the Avenue's swank shops, but this one crept in and it looks rather permanent. Because of its location, the interior designing of this self-service restaurant took on a special importance. The dull and drab had to be avoided just as much as the screaming, sanitary appearance of gleaming white tiles and brilliant lights. With the help of plastics and other modern materials of decoration and construction, a cafeteria that even stately Fifth Avenue can be proud of, has emerged.

Upon approaching the restaurant we get our first glimpse of plastic applications. Methyl methacrylate hardware clips are now being used to replace putty, metal bars and clips formerly employed in holding together sheets of plate glass. The plastic affords an unbroken line of transparency and brilliance never before possible with other materials. It is believed that this installation represents the first time that such a use has been made of plastics. (*Please turn to page 86*)

1—An idea of the spaciousness and brightness of the new Bickford restaurant is evident in this view looking toward Fifth Avenue. Note the clear plastic rods on the doors and the frames supporting the window display signs. **2**—Counter signs throughout the restaurant are mounted in transparent plastic stands. **3**—Sheets of translucent plastic joined with clear rods shield fluorescent lamps encircling the ceiling

1

2

1—Filling machine has an orifice through which the plastic is injected into the defect. Lumber travels on the roll case beneath. 2—Two 1-ft. pieces of 2 in. by 6 in. sheathing show one untreated and two treated pitch pockets

Patching defective lumber

Woodflour plastic used to plug worm holes makes degraded lumber usable

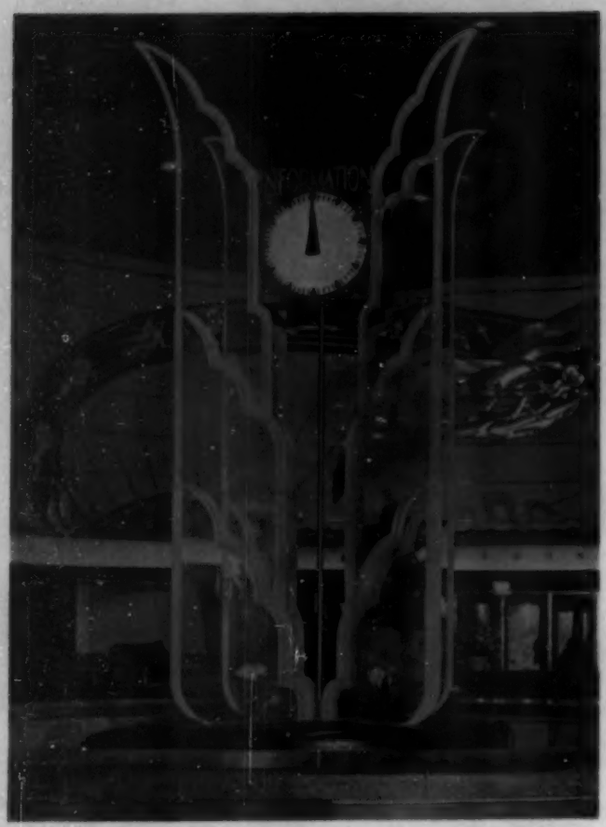
OUT in the northwestern part of the United States where the timber grows tall and the tree trunks are almost as big as a house, a woodflour plastic has been developed for use in filling worm holes and in the repairing and filling of small knots and pitch pockets in lumber that is otherwise high grade. This plastic, which becomes an integral part of the lumber, was developed in an attempt to salvage some of the fire-killed timber which is being attacked by the round headed wood borer.

The plastic is a mixture of cellulosic esters and ethers, in the presence of volatile solvents, suitably modified by various plasticizers and resins. The filler used is largely fir wood flour. Machines and handling methods employed in the plastic-plugging operation are relatively simple. After the lumber has been dried and blanked, the holes or defects to be filled are cleaned or routed out with tools designed for this purpose. The lumber is then rolled toward the filling machine where the holes are centered under it and filled with the plastic under about 700 lbs. pressure per sq. inch. This process is fast and continuous, making it possible to handle large quantities of lumber each day. After the defects are plugged, the lumber is stacked and the plastic allowed to dry. When hardened, the wood is re-run to pattern, or if the lumber is already finished, the filled portions are merely sanded in order to remove the surplus plastic material.

The advantages of being able to repair lumber with a material that becomes homogeneous with it are many. Timber which was formerly considered worthless can now be salvaged, thus creating an appreciable increase in our lumber supply.

Several tests made to prove the rot resistance of the plastic had very encouraging results. These tests were conducted by George M. Hansen in the forestry and pathological laboratories of Oregon State College. One test involved 10 cycles of wetting and drying over a period of 6 days, using Douglas fir boards $^5/_8$ in. thick with $^1/_2$ in. and $^5/_8$ in. diameter holes filled with the plastic. At the end of the sixth day, the plastic was still intact and unaffected by the water, although the wood had undergone severe shrinkage and swelling.

Another test encompassing (*Please turn to page 88*)



AIRLINES TERMINAL

Four great stylized wings of translucent plastic, supporting a four-faced clock, constitute an ornamental center-piece decoration for the main rotunda of the new million-dollar Airlines Terminal at Park Ave. and 42nd St., New York. Each of the four wings is cut from three pieces of specially cast acrylic, ranging in thickness from $2^1/_2$ inches to $1^1/_2$ inches. The individual pieces are cut at their joining points in a series of curves and the pieces are welded together with a special material, making an invisible joint with each wing forming a complete unit as though from a single casting. In preparing the plastic, it was necessary to sand-blast the edges of the wings and certain surface lines that create the wing design. It is these surfaces that become luminous and are the visible lines of the stylized wings. The entire motif stands 11 feet, 9 inches from the floor to the top of the wings. Each wing unit after welding is 12 ft. wide and 8 ft. high, and the motif rises from a circular base in the center of the waiting room, which in turn is the central feature of the information counter. Mechanically strong, and optically clear the unit is constructed so that there is no strain released and light transmission is uninterrupted.

Credits: Plexiglas; designer, Oscar Bach; fabricator, Regal Glass Co.; architect, John B. Peterkin.

PRODUCT DEVELOPMENT

RADIO PLUS LAMP

Something new in lamps—and radios—is this table lamp that combines a radio in its base. Attractive in its cream and gold color, it has a base that is molded of phenolic material in two sections. While externally the two sections are the same in appearance, the pieces are molded in separate dies, then sprayed to achieve the rich gold color. The shade blends with the base and has a self-fold trim with gold piping. A 5-tube radio with a full-sized electro-dynamic speaker adequately baffled for volume handling capacity is housed in the lower structure. Tiny as the unit may seem, there is a complete band coverage. Of great satisfaction to many users is the fact that the radio will operate on either AC or DC current. No aerial or ground wires are necessary. The complete lamp stands $21^5/_8$ in. tall and the base measures $6^1/_4$ in. by 6 in.; the diameter is $5^1/_2$ inches. A reflector beneath the shade provides direct-indirect light which is controlled by a 3-way switch. Selective lighting, 50, 100 or 150 watts, is thus made possible. A black phenolic compound is used for the base which is subsequently sprayed for final harmonizing appearance.

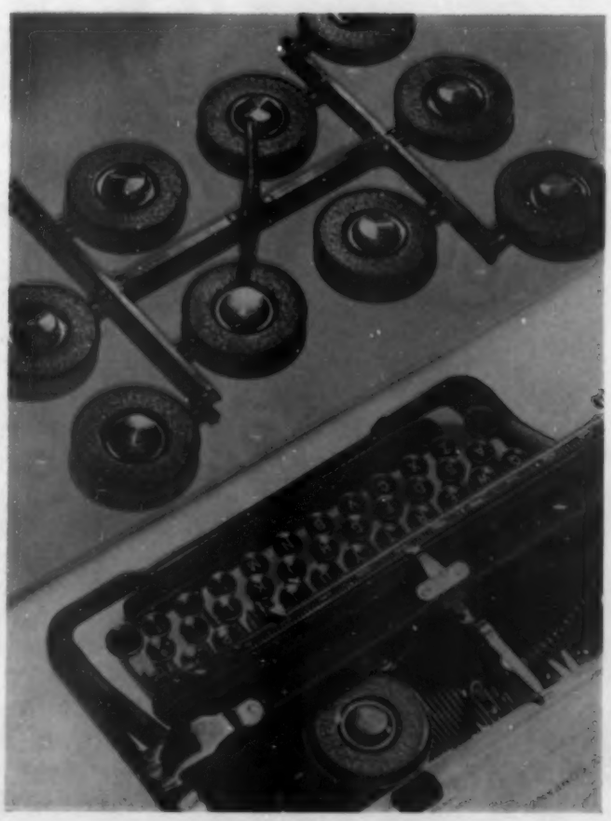
Credits: Durez molded by Midwest Molding & Mfg. Co. for Mitchell Mfg. Company.

EFFICIENT STERILIZER

The proper sterilization of china, silver and other utensils used in restaurants, soda fountains and other places where food is served is a problem that public health authorities watch with unrelenting vigor. A new sterilizing unit, designed especially for use where the management wishes to impress upon its patrons the unusual steps that are taken to safeguard their health, makes use of plastic material for some of its parts. The housing for the sterilizer is molded of black phenolic or ivory urea. Tubular containers with plastic caps hold the germicide concentrate in such an arrangement and quantity as to assure a definite strength to the rinse solution regardless of the rate of water flow. A particularly important feature of the unit is the pH adjuster incorporated in the model. Extensive research has proved that pH (acidity or alkalinity) of the sterilizing solution has an important bearing both on its stability in storage and its germ-killing properties. It is claimed that sterilizing solutions best maintain their full strength in storage when kept at high pH, but they have a far superior germ-killing effectiveness in use when the pH is low. This unit is said to compensate automatically for both of these factors. Available for home use also.

Credits: Durez and Plaskon; molded by McDonald Mfg. Co. for National Technical Laboratories.

PRODUCT DEVELOPMENT



SPOOL COVERS

Trends in typewriter designing lean toward enclosing as much of the machine as is possible. This not only helps to protect the working mechanism, but reduces noise. The covering of the ribbon spools is not an innovation, but the fact that these spool covers are now being molded of plastics is new and interesting. Here we see a group of covers, injection molded of cellulose acetate, 10 at a time. Look closely and you will notice that the top of the cover has the same bright-and-wrinkle finish as the metal parts of the machine. These covers are made ready for assembly by simply trimming off the gate scrap. Because of the resilience of the plastic material, two projecting prongs molded on the underside are all that is necessary to hold the covers securely in place. Plastic covers have advantages over metal in that they will retain their finish, will not mar or scratch, are unaffected by cleaning fluids, and pleasant to handle. They are, of course, lightweight, and can be kept clean by merely rubbing them off with a damp cloth. Fluted sides on the upright knob in the center permit a firm grip thereby facilitating easy removal.

Credits: Tenite molded by The Thomas Mason Co. for Underwood-Elliott Fisher Company.

1—For artificial resuscitation in emergency work, this compact, lightweight General-Collins respirator lung is easily handled in ambulance or first-aid station, as well as in the hospital. The transparent cellulose acetate chest piece covers the upper part of the body only, allowing greater freedom and comfort. **2**—Several sizes with rubber cushions are available for adults, children, and infants

Breathe easily

THE human body can go for many weeks without food, and many days without water, but only for a few minutes without oxygen. There are times when artificial aids are vital to help the body take in the oxygen needed to sustain life—such means include the prone pressure method of respiration and various types of so-called iron lungs and respirators. Plastics now enter the field and are ingeniously used in two new respiratory devices.

An emergency lung, jointly developed by Warren E. Collins, Inc., and General Tire and Rubber Co., features a dome-shaped transparent cellulose acetate chest piece which confines the resuscitating pressure to the upper part of the body. The entire unit consists of this light, plastic part, available in several sizes, and pumping unit which creates a rhythmic, intermittent gentle suction. When the chest pieces are placed in position, the gentle suction rhythmically raises the chest and inflates the lungs very much as does the famous iron lung, or as in natural breathing. Both the depth of breathing and the rate are controllable and adjustable.

Light weight, resiliency and ease of forming were prime factors in the selection of the acetate sheeting. For the larger size domes, 24-in. squares in fairly heavy gages are used. Smaller sizes are made from sheets of

21 in. width and cut from various lengths. In forming the units, the sheets were not allowed to touch the lower cavity of the mold but were simply pinched along the edges—no male or female dies were needed. This method of fabrication saved the surface of the material from possible blemishes in manufacture or assembly.

The basic unit of the lung consists of three graduated chest pieces, with a pumping mechanism to produce and regulate the intermittent suction required for operation. The chest pieces are of graduated size to enable them to be used for adults, children and even infants. These plastic pieces have a pneumatic cushion with a sealing flap of sponge rubber around the edge. The cushion creates the air-tight enclosure necessary for the effective application of the chest-raising suction, with comfort for the wearer. In most cases the chest pieces fit without any adjustment, but if necessary, the shape of the plastic part can be modified by softening with hot water or steam.

Because of its compact size and portability, the lung will have its greatest use in emergency work where the big iron lung could not be made available—for instance, in ambulances, fire and police department relief work, at beaches and in industrial plants. While not intended for long-period use in infantile paralysis, it seems likely to be a useful adjunct to the larger iron lung in the care of patients who may require artificial respiration for long periods, offering an occasional change. Easy on the patient, it allows greater freedom for the arms and legs, and permits him to be in a semi-reclining or even a sitting position. Further, it enables giving treatments which may be inconvenient in the cumbersome iron lung. It is said to be more effective than prone pressure or artificial respiration because it expands the chest instead of compressing it and it is less tiring for both patient and operator.

Another development in the field of therapy equipment is the Puritan mask and bag, created by Puritan Compressed Gas Corp., for the nasal administration of oxygen and mixtures of medical gases. Although the unit consists of 4 parts, the total weight is only 3 ounces. The nose piece is made of a semi-transparent cellulose acetate which will not irritate the skin, and has a smooth, rounded surface devoid of corners and angles. Fitting closely with no discomfort, it is shaped to direct the flow of expired gases down into the bag by separate ducts. The shape may be changed by warming the mask in water at 160 to 180 deg. F. and forming by thumb pressure to conform to the contours of an unusual face. Immersion in cold water must follow this immediately to retain the desired shape of the plastic. The bag-to-hose connection is plastic too, and is held in position by the opening in the bag. All parts are replaceable.

In addition to its therapeutic uses, the mask and bag is convenient for use in aviation where relief from the effects of high altitudes are vital without interfering with the routine duties of the operators. The lightness of weight plus the easy workability make plastics ideal for use in this field.

Credits: Tenite; Lumarith for small size lung.

3

3—Semi-transparent cellulose acetate is used for the mask of the Puritan unit. Lightweight, the entire apparatus, consisting of plastic mask, supply bag, head strap, hose connector and tubing, provides simple therapeutic administration of oxygen and various types of medical gases

Plastics in Review

1

1 A quick and easy method of two-way, inter-office communication is made possible through the Philcophone. Master control unit, knobs and dials are molded of Durez. Equipped with 4 push-button controls, the unit can accommodate 5 stations. A "Quiet" button on the master, and a "Talk" button on the remote control receiver provide additional means of control. Molded by Northern Industrial Chemical Co. for Philco Corporation

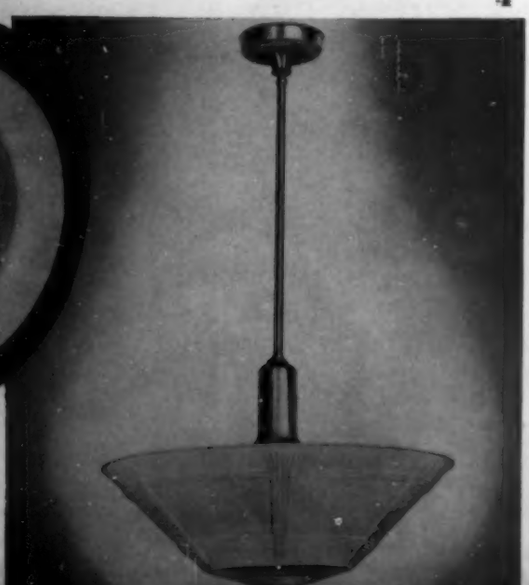
2 New-born babies can now be seen as well as heard. These newly designed basinets are made of clear Fibestos, permitting full vision to the nurse from all parts of the nursery. The sides of these modern cribs can be made higher without impairing visibility, thus helping to protect the infants from drafts and contagion. The plastic material is joined to a chromium plated tubular frame, making the entire assembly easy to wash and keep clean. Designed by Leo Jiranek in collaboration with Dr. J. W. Boren. Manufactured by Lloyd Mfg. Company

2

3 It's smart—it's modern and it plays a merry tune. This is the "Streamliner," a graceful, new, two-tone Catalin radio manufactured by the Fada Radio Corporation. Smooth, sleek and lustrous, this cabinet is made in a maroon shade with ivory trim. The case will retain its new look, and by wiping it off with a damp cloth it is readily cleaned. Simple, flowing lines of its design indicate it as an ideal accessory for modern interiors

3

4 A new Westinghouse, semi-indirect luminaire suitable for general illumination of commercial interiors employs a basin of translucent Beetle or Plaskon that gives a soft, pleasing glow.



4

Light cut-off is variable, the basin supports having 2 positions, either one of which may be used. All hanger parts are finished in "satin chrome." The unit is molded by the Hemco Plastic Div. of Bryant Electric Company

5 Schools, laboratories and camps—even hobbyists—will be interested in this new method for mounting biological specimens. The mounts consist of 2 flat sheets of Fibestos with a hollow drawn in the center of each. Butterfly, beetle, or whatever the specimen may be, is laid flat on one sheet with the body of the insect restive in the hollow. Another sheet of the same size is placed over this so that the wings and limbs are between the sheets while the body rests in its own cavity. The sheets are then cemented in place. This mount is permanent, fully visible and insect-proof. Mounts are manufactured by Frank Schwarz Studio. Distributed by Central Scientific Company

6 Restyled from stem to stern, the Telautograph telescriber is compact, well designed and efficient. The machine has a window made of Plexiglas that will permanently retain its clarity. Resistant to warpage and shrinkage, the material cannot be broken except by a hard, direct blow. In producing this piece, the plastic was cut with a wooden saw, heated in an ordinary oven and bent to specifications on a wooden frame

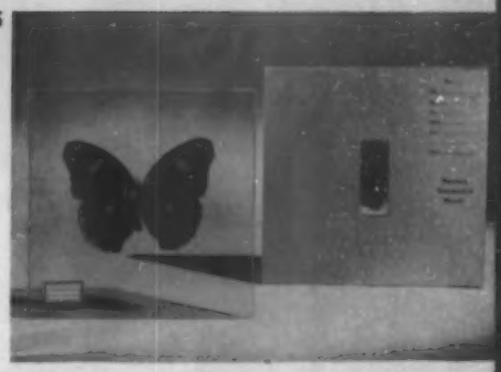
7 Here is a shiny toy bathroom that looks exactly like its grown-up counterpart. All of the fixtures are molded of Lumarith and it has real faucets that run water. A long, narrow pan clamped to the back of the wall acts as a reservoir. The material will not chip when struck or dropped, a real safety feature whether for use in real bathrooms or as toys. This is a product of the Wolverine Supply & Mfg. Company

8 You can use this skirt marker yourself without any fuss or annoyance. The metal weighted base in the deluxe model is molded of maroon Tenite, while the powder dispensing head is molded of this same plastic, or of Plastacele. Molded plastic parts in the Economy model are black. Specially constructed to insure a thin straight marking line, the device has a ruler designed for easy and accurate measuring. Distributed by Consolidated Sewing Machine & Supply Co., Inc., it was designed by Max Ingwer

9 Many a pistol owner is proud of his possession when it has a molded plastic pointer stock. Available in ivory, walnut, redwood and ebony colors, these stocks are shock-resistant, as well as impervious to oils and acids. They have a full corrugated thumb rest. Designed to be used with most brands of pistols, they are molded of Bakelite phenolic and urea by American Molding Co. and distributed by Walter Murad

10 Testing engineers have long sought a strain gage which would be sensitive and accurate, lightweight and inexpensive. A combination of Lucite, fabric and a wire filament has produced the desired effect in the unit, SR-4 Bonded Metalectric Strain Gage offered by Baldwin Southwark Division of the Baldwin Locomotive Works. Use of the plastic assures dimensional stability, moisture resistance and good insulating properties. Strain can be measured down to 20 lbs. per sq. in. in steel and frequencies of over 30,000 cycles per sec. have been measured without distortion. Cigaret shows actual size. Control box is pictured above

5



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11 Converting standard pint, quart or ½ pint milk bottles into handy, sanitary dispensers for iced tea, ice water and other beverages, the Sure Pour cap clamps firmly around the rim of the bottle. It is held in place by an adjustable metal rod on the top and the rectangular spout pours without dripping. Available in various colors, it is molded of cellulose acetate by Columbus Plastics Products, Inc. Trade names or advertising can be imprinted for premium use

12

12 Colorful set of kitchen utensils made with matching injection molded washable plastic parts, include a whipper with ridged handle, dripless servers with tops and handle of the same material and a small finely meshed strainer. Handle and rim of the strainer are molded in one piece and then formed around the wire mesh by heat and pressure so that it cannot fray or work loose. Various bright colors are obtainable. Worcester Moulded Plastics Co. mold the plastic attachments of Tenite II for Washburn Company

13

13 Away with the hypo bugaboo. The Photrix print washer used flowing water to remove the hypo from print fronts and to wash the porous backs simultaneously, thus eliminating fading and discoloration. A 3-ft. hose is attached to a faucet and the motion of the water through 14 jets to the holes at the other end keeps the prints suspended. Invented by Dr. Walter M. Mitchell, the device is chemically resistant and noncorrosive. It's molded of Bakelite phenolic by Universal Plastics Corp. for Intercontinental Marketing Corporation

14 Cornering the center of weather conversation, Precision Products Co. have styled its smart new line of thermometers like handsome desk clocks. Numerals stand out clearly against a glass background, enabling accurate readings at a glance. Dials are set firmly into decorative, durable bases of Catalin, which are made in gem-like, solid and mottled colors

15 Hand-turned handles of crystal-clear Lucite in several easy-to-hold designs have been introduced in the Ever-Ready shaving brush line by American Safety Razor Corp. Bristles are set in colored, hard rubber which shines through the transparent plastic. The brushes are packaged in dome-shaped boxes of transparent cellulose acetate made by Imperial Paper Products Company

16 Dainty tie backs of transparent Lumarith add sparkle to window drapes without detracting from the design of the material. Smoothly rounded, there are no sharp edges to cut fabrics or scratch hands or walls. A dampened cloth wipes them clean and they are practically unbreakable. Pale tourmaline, pink, deep sapphire, blue and sea green as well as clear colors are available. Molded in several styles by Modern Plastics Co. for Kirsch Company

17 Atomette, purse size perfume dispenser has been restyled with a protective cap which keeps the dispensing tip free from tobacco and other particles. Said to be proof against eakage, spilling and evaporation the atomizer comes in six models in various styles and prices. They're made in black or ivory Plaskon with contrasting colored tops. Some bases are covered with nickel, gold, silver or enamel to add decorative swank. Molded by Chicago Molded Products Corp. for Atomette Company

14

15

Plastics in Review

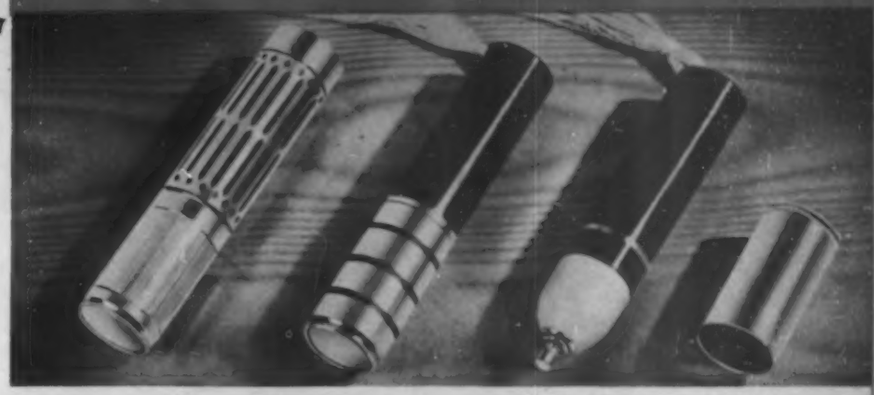
18 Speaker grilles, lettering and modern lines are molded integrally with the rest of the cabinet of this Pilot table model radio. Measuring $8\frac{1}{2}$ in. by 15 in. by $6\frac{1}{2}$ in., the cabinet is available in walnut Resinox and ivory Beetle. Color and surface and smooth finish are inherent in the plastic surface. The dial is set at an angle for convenient visibility. Molded by Associated Attleboro Mfrs., Inc., for Pilot Radio Corporation

19 Draftsmen and engineers find these transparent Crystalite rulers allow an unobstructed view of their work even in use. Almost $\frac{1}{4}$ in. thick, these strong inkproof moldings hold metal inserts securely and accurately in place without warping. They lie flat and will stay straight in service, we are told. Molded by Vard Mechanical Laboratories

20 In addition to allowing all-around visibility, the transparent plastic "convertible coupe" top on the new *Ercoupe*, all-metal, two-seater monoplane, changes the open cockpit to a completely closed cabin in a jiffy. To make this possible, stationary windshields and rear windows and the adjustable center enclosures are all fabricated from clear polished Vinylite sheets, and the transparent center panels can be lowered into the fuselage skin on either side. Only 0.065 in. thick, the plastic sheets are reported to be permanent in size and color, rigid enough to withstand the pressure of an air stream of 100 miles per hour, practically non-flammable and sturdy enough to meet the onslaughts of rough weather

Manufacturers names and addresses are available upon written request to the Editor

17



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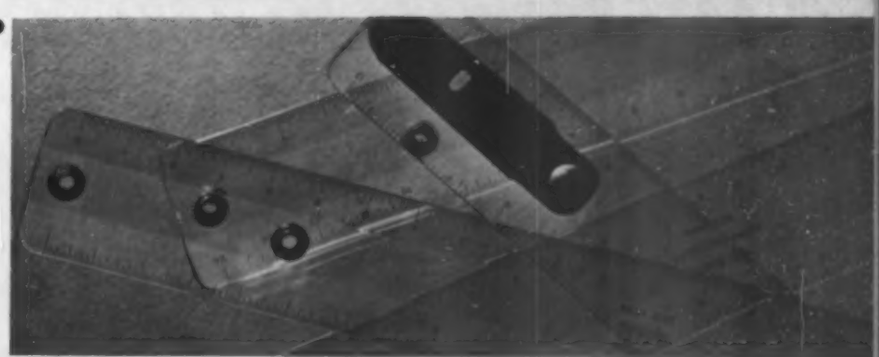

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Plaskon is available in a wide range of rich, beautiful tones, offering unlimited

or large intricate moldings

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PLASKON

★ MOLDED COLOR ★

Readily playable without any special instruction, the Hammond Solovox adds lovely solo voices and orchestral tones to piano music. Dr. Frank Black, National Broadcasting Co. (at left) demonstrates the accessibility of the device. Below—Plastic parts include 36 keys, 2 end caps, 12 control tables and the volume control cam, all compression molded urea and phenolic

Symphony at home

Intricate plastic shapes, economically produced, enhance the appearance and operation of a novel piano attachment

THE Solovox, a new electronic instrument designed to be used as a musical adjunct to any piano, employs molded plastics for its black and white keys, for the end caps, control tablets and the volume control cam. This instrument which looks like a small piano keyboard, is really quite an ingenious invention. It provides the pianist with a wide variety of solo effects, including the violin, 'cello, horns and many others. The piano serves as an accompaniment for the instrument providing new and pleasing effects.

Molded urea and phenolic materials used for the 36 miniature playing keys insure a lasting, good appearance because of their permanent finish which will not wear off or chip. The keys are also lightweight and of low cost in quantity production. In front of the keyboard are 12 tilting tablet controls which govern the tone quality, tonal attack, the register in which the tones are to sound and vibrato. These controls are also molded of either urea or phenolic material depending upon the color desired—brown, black or ivory. The two end housings or caps and the volume control cam in this area are of plastic, too, in order to achieve maximum electrical insulation, and resistance to abrasion along with good looks.

The instrument consists of 2 separate parts. A small 3 octave keyboard with control tablets providing a possible range of 6 octaves is attached to the underside of the piano. A tone cabinet containing the electrical equipment is connected to this small keyboard by means of a cable fitted with plugs for ready connection. In the case of a grand piano, this tone cabinet is completely hidden from view by mounting under the piano. In the case of a vertical piano, the tone cabinet, very shallow in depth, is set along one side of the piano without requiring extra space.

The operation of this instrument is entirely electrical, there being no strings, pipes, woodwinds or other musical vibrators. The tones (*Please turn to page 96*)

Plastics in strange places

by JULIAN F. SMITH*

So great is the versatility of the familiar raw materials for plastics that their useful properties often lead them into unexpected applications. This is because many uses for plastics have strayed far from the beaten paths followed by moldings, films, foils and the like. The casual observer is astonished to find cellulose derivatives or synthetic resins doing work apparently quite unrelated to plastics, and only he who looks beneath the surface sees logic behind many of these developments.

A few outstanding examples of these apparent oddities are briefly outlined here. Some are in the field of medicine; others are chemical in nature, or electrical, mechanical or optical, or related to such basic needs as food or clothing. The selected examples do not by any means exhaust the field; they have been chosen merely to illustrate the wide range of uses having little or no concern with plasticity.

Softer water for thirst or for boilers

Water softeners are necessary chemicals because hard waters must be tamed. Economy demands regeneration of the spent chemical because in treating millions of gallons the cost would become prohibitive if each charge were discarded after being used only once.

Water for high pressure boilers must be soft, but it must be neither acidic enough nor alkaline enough to corrode the boiler. The ordinary silicate base exchange water softeners can be regenerated only by very weak acids, too weak to give the silicate power enough for removing bicarbonate hardness from water. Consequently these softeners leave the water too alkaline for a high pressure boiler's digestion.

Enter now the rescuer, a synthetic resin base exchange compound which can be regenerated with strong acids such as hydrochloric acid. The regenerated chemical has ample power to remove bicarbonate hardness, yielding water which is harmless to the boiler. These resinous water softeners are made by sulphonating phenol-aldehyde condensation products. They are described in a number of U. S. Patents, including 2,195,196 of March 26, 1940 (Hans Wassenegger and Robert Griessbach) and 2,204,539 of June 11, 1940 (Hans Wassenegger and Karl Jaeger), both assigned to I. G. Farb. Akt., Frankfort, Germany. These resins are marketed in Germany under the trade name *Wofatites*, and are described by A. Richter in *Angewandte Chemie 52*, 679 (1939).

One good turn deserves another, and it is interesting that synthetic resin water softeners call in other plastics to protect materials from the strong acid used in regeneration. Chlorinated rubber paint and Igelit foil linings serve to prevent corrosion in filters and pipe connections.

The Permutit Co. has developed a different type of organic water softener, made by sulphating wood, lignite or the like. Among their patents for these products are 2,191,059 and 2,191,060 of February 20, 1940 (Otto Liebknecht, inventor). Improvements in phenol-formaldehyde resins, sulphited to impart ion exchange properties, are disclosed by Eric L. Holmes in his U. S. Patent 2,191,853 of February 27, 1940.

Still another type of synthetic resin water softener, operating by selective adsorption, has been patented by Willis A. Gibbons (Canadian Patent 378,655 of January 3, 1939, assigned to Dominion Rubber Co.).

Ladies like white leather

Sulphonated phenol-aldehyde resins, chemically similar to the water softeners discussed above, have been known for a long time as effective tanning agents. But polyacrylic and polymethacrylic acids have been introduced recently as novel synthetic tans. They are disclosed in U. S. Patents 2,205,882 and 2,205,883 of June 25, 1940 (George D. Graves, assignor to E. I. du Pont de Nemours and Co., Inc.). They have the special merit that they yield a genuinely white leather because, unlike most synthetic tans, they do not need the aid of a vegetable tan or a metal compound. These aids color leather so much that even after bleaching it retains a bluish, greenish, yellowish or grayish tinge not seen in the clear natural whiteness of leather tanned with acrylic or methacrylic acid polymers.

Rotproofing wood

Departing from all previous methods of preserving wood from decay an Austrian inventor utilizes an inorganic tanning agent in combination with a synthetic resin. The inorganic compound may be, for example, potassium dichromate and the resin may be a phenol-formaldehyde or urea-formaldehyde condensation product. The dichromate helps to harden the resin without heat. Wood treated in this way is exceptionally resistant to attack by water, molds and bacteria. The invention is described in Austrian Patent 156,353 of June 26, 1939 (Heinrich Prüfer).

Swimming pool matches

According to U. S. Patent 2,193,124 of March 12, 1940 (Albert B. Doran, assignor to Herbert R. MacMillan) alkyd resins impart (*Please turn to page 90*)

* Hooker Scientific Library, Central College, Fayette, Mo.

Stock Molds

SHEET ONE HUNDRED-FOUR

Cosmetic containers are available from stock molds in 1/30, 1/16, 1/8, 1/4, 1/2-in. sizes in solid colors or two-tone combinations. Handles and knobs have varied uses. For manufacturers' names and addresses, write Stock Mold Dept., Modern Plastics, Chanin Building, New York, giving item and sheet numbers

---

1294. Hollow stove handle 10 1/2 in. long; ends measure 2 25/32 in. long; 3/32 in. metal strips through center. Metal inserts and molded bosses at each end

1295. Two-piece cosmetic container, 1/4 oz. capacity. Has base 1 3/4 in. overall diameter; top diameter 1 11/16 in.; 1/4 in. deep; decorated top

1296. Two-tone cosmetic container same dimensions as 1295 but with different top, and molded-in letters

1297. Hinged 1/4 oz. cosmetic containers with mirror in top. 1 13/16 in. overall diameter. Depressed lettering and recessed area on bottom. Depressed decoration on cover

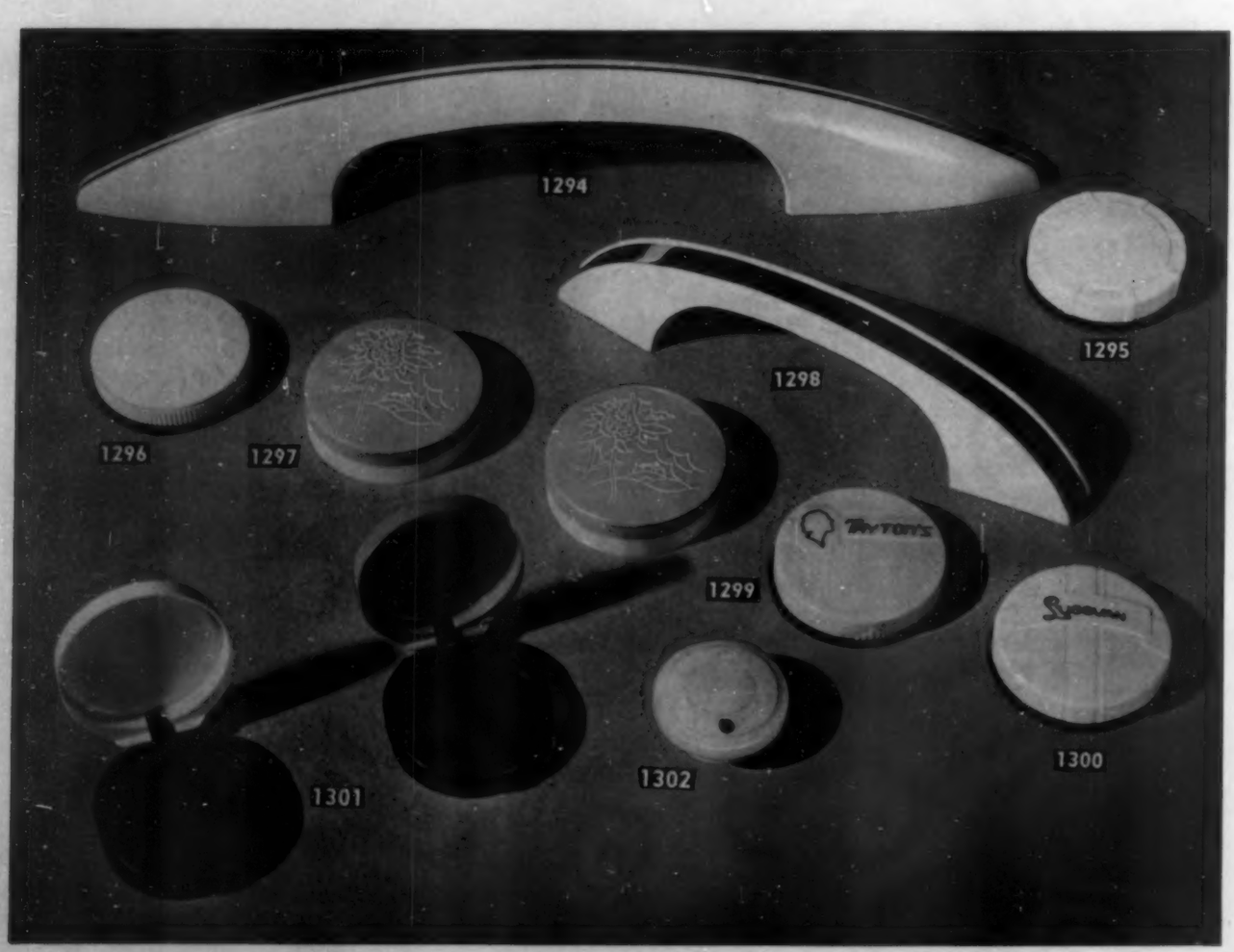
1298. Solid handle 5 15/16 in. long; cored-out ends 1 1/4 in. long with brass insert in molded part; 5/16 in. decorative chromium strip through center

1299. Two-piece cosmetic container, same as 1295 but with decorated top. Has raised and depressed letters in same and wiped-in colors

1300. Cosmetic container same as 1295. Decorated top with depressed lettering in contrasting color

1301. Hinged oval cosmetic containers 1 9/16 in wide; 1 3/4 in. long; 3/16 in. deep, depressed lettering on cover; recessed area on bottom

1302. Hollow knob 1 1/4 in. overall diameter, with molded in post containing threaded 1/4 in. brass insert. Slotted headless set screw is furnished for holding knob to shaft for fastening



Polyvinyl alcohol plastics

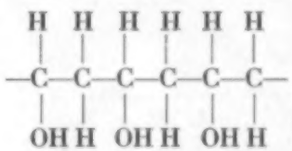
by E. S. PEIERLS[1]

THE constant extension of new fields of use for plastics—with far-reaching effects upon the fabrication of both everyday and luxury commodities—is a favorite industrial topic. In the last few years a new group of substances has come to the fore: polyvinyl alcohol compounds, that constitute a link between the various plastics, rubber, and synthetic rubbers. These new polymers claim for themselves a wide range of applications peculiarly their own.

Resistoflex PVA, the trade name of the Resistoflex Corp. for these polyvinyl alcohol plastics[2] in their final manufactured form, has for its basic material a powdered white or yellow resin which, until compounded and partly processed, is neither thermoplastic nor thermosetting, differing in this respect from the common definition of plastics. With proper handling, however, it can be molded to any shape. On the other hand, polyvinyl alcohol has certain rubber-like physical characteristics such as pronounced flexibility, elasticity and resiliency. The processes for molding and shaping it, furthermore, partly parallel the technique of the plastics industry and partly are modifications of those common to the rubber industry. It differs from the rubbers, however, in many ways, including the fact that it does not require vulcanization. To make its classification even more unique, this synthetic resin is the only commercially known flexible material that is not only resistant to, but *entirely unaffected* by, the action of gasoline, oils and most of the common organic solvents.

A further remarkable property is its apparent immunity to aging. The polyvinyl alcohol compound may harden slightly during long service, but no excessive loss of flexibility is observed. It does not check or crack, and its usefulness is not impaired. Toughness, high tensile strength and resistance to pressure, impact and torsion are among its other characteristics. Data concerning various properties of the extruded and molded types of polyvinyl alcohol are presented in Table I.

An acetylene derivative, polyvinyl alcohol has its origin in those same three raw materials, coal, limestone and air, which are playing such a big role in modern chemical synthesis. The intermediate stages involved the formation of vinyl acetate, which is subsequently polymerized. Polyvinyl acetate through the hydrolyzing action of an alkali is converted into polyvinyl alcohol, a powdery resin which with further compounding and processing becomes PVA. The structural formula of polyvinyl alcohol is expressed thus:



The discovery of polyvinyl alcohol, and modern

TABLE I. PROPERTIES OF POLYVINYL ALCOHOL PLASTICS

Property	Extruded PVA	Molded PVA
Tensile strength, lbs. per sq. in.	5236	2121
Elongation, percent in 2 in. at break	213	445
Permanent set,[a] percent	78	80
Clod flow,[b] percent	63.2	63.6
Dielectric strength,[c] volts per mil	610	1070
Electrical conductivity, ohm-cm.	3.1×10^{7}	3.8×10^{7}
Thermal conductivity, cal. per sec. per sq. cm./1°C. per cm.	5×10^{-4}	18×10^{-4}

[a] This is the percentage elongation measured after stretching to three-fourths of ultimate elongation, holding for ten minutes, releasing, and allowing to recover for ten minutes.

[b] This is the percentage deformation of a 0.5 in. cube subjected to a pressure of 4000 lbs. per sq. in. at 120°F. for 24 hours and allowed to recover for 24 hours.

[c] Test made at 72° F. and 50 percent relative humidity.

1. Resistoflex Corporation.
2. ED. NOTE: Polyvinyl Alcohol (PVA) plastics of various types and viscosity grades suitable for different fabrications are also available from the R. & H. Chemicals Dept., E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.

developments in the utilization of its compounds, are not without interest. As early as 1838, Regnault described vinyl chloride in the literature. Klatte's discovery of the acetate of polyvinyl alcohol, in 1913; laboratory determinations by Hermann and Haehnel, in 1927; and researches by Staudinger and his associates, are most prominent in the historical background. But the genesis of the industrially important polyvinyl alcohol materials dates back to only some ten years ago.

Cast in the principal roles were a keenly imaginative law student and his acquaintance, an automotive accessory manufacturer who dreamed of a synthetic flexible hose that would be absolutely unaffected by fuel or oil contact. The law student chanced to hear of a new rubbery synthetic compound that had been recently developed. Through him the automotive man's dream found actuality in the shape of fuel, oil, lubricating lines, etc., made from this polyvinyl alcohol compound, now used extensively in automotive, aircraft and general industrial fields. So primitive was the original technique of making this hose that glass rods were repeatedly dipped in a solution of polyvinyl alcohol until a sufficiently heavy tube had been formed.

About five years ago, Resistoflex Corp. acquired certain patent rights and organized for large scale fabrication and distribution of polyvinyl alcohol products. Working with a synthetic resin of superior quality, this corporation through painstaking research has developed improved processing, molding and extrusion methods and equipment for manufacture of such items as tubing, hose, gaskets, washers, diaphragms, sheet material, molded shapes, and dipped goods. Polyvinyl alcohol hose and tubing, in particular, have been highly perfected and already have gained recognition in numerous industrial fields. These—to mention

TABLE II. EFFECT OF VARIOUS SOLVENTS ON THE PHYSICAL PROPERTIES OF EXTRUDED POLYVINYL ALCOHOL
Samples immersed in solvents for 240 hours at room temperature.

Test	Specific Gravity at 72° F.	Shrinkage or Expansion in 6 in., percent	Tensile Strength, lbs./sq. in.	Elongation in 2 in., percent	Hardness (Durometer)
Original Material Before Immersion	1.259	—	5,236	213	85
66% Gasoline by Volume 24% Ethanol 10% Benzene	1.195	−1.0	5,057	180	86
Gasoline (leaded)	1.260	−0.30	5,255	220	85
Kerosene	1.255	+0.30	5,247	220	84
Benzene (Benzol)	1.251	+0.30	5,290	225	84
Xylol	1.260	+0.20	5,351	220	84
Acetylene Gas	1.256	+0.10	5,340	220	85
Methylene Dichloride	1.261	−0.40	5,110	225	84
Trichlorethylene	1.253	+0.10	5,140	225	86
Carbon Tetrachloride	1.259	0.00	5,084	145	84
Monochlorbenzol	1.258	+0.10	5,026	190	84
Methanol (Anhydrous)	1.203	−6.50	5,980	195	86
Ethanol (Anhydrous)	1.181	−4.30	5,779	190	87
Ethylene Glycol	1.186	+4.70	4,335	185	77
Acetone	1.246	−1.20	5,203	175	87
Petrohol	1.224	−1.30	5,971	165	89
Furfurol	1.250	−2.00	5,890	175	88
Methyl Acetate	1.269	−0.70	5,403	185	85
Ethyl Acetoacetate	1.258	−0.50	5,491	205	85
Diethyl Ether	1.260	−0.30	4,980	230	86
Dioxane	1.271	−1.30	5,272	195	85
"Freon" Gas	1.270	−0.50	5,636	205	86
Butane Gas	1.268	+0.30	5,352	200	86
Propane Gas	1.267	+0.20	5,529	200	87
Sulphur Dioxide	1.269	+0.50	5,497	215	86
Aniline	1.256	−0.70	5,557	185	86
Formamide	1.201	−4.00	3,845	195	77
Oxygen bomb accelerated aging test 300 lbs. oxygen pressure at 160° F. for 240 hrs.	1.259	+0.10	4,990	220	86

1

2

1—Entirely unaffected by and resistant to the action of gasoline, oils, skin, irritants and most organic solvents, polvinyl alcohol plastics have been used for these strong, flexible, transparent protective gloves. 2—Extruded PVA tubing, because of the above properties plus its flexibility and resiliency, has gained recognition in numerous industrial applications. 3—In the automotive field, it has been used for the oil filter hose as shown

3

a few—include aircraft, automotive and truck manufacturing and operation; service station equipment; refrigerant and air-conditioning apparatus; cleaning fluid and fire extinguishers; the paint industries; hydraulic operations, machine tools, instruments, petroleum, gas, and chemical industries. This hose does not differ markedly in design from conventional multilayer hose construction, the difference being that at least one layer consists of polyvinyl alcohol.

The imperviousness of this material to hydrocarbons and to both natural and manufactured gases—which constitutes a distinctive and strong appeal to industries where gasoline, oils, greases, refrigerants and solvents

TABLE III. MAXIMUM TENSILE STRENGTH AND ELONGATION OF POLYVINYL ALCOHOL AT VARIOUS TEMPERATURES IN AIR AND KEROSENE

	Extruded Type				Molded Type			
	Tensile Strength, lbs. per sq. inch		Elongation in 2 in. at Point of Rupture, percent		Tensile Strength, lbs. per sq. inch		Elongation in 2 in. at Point of Rupture, percent	
Temperature	Air	Kerosene	Air	Kerosene	Air	Kerosene	Air	Kerosene
−25° F.	7,692	7,990	30.0	32.0	7,428	7,360	40.0	30.0
0	6,805	7,010	85.0	90.0	6,785	6,550	85.0	90.0
32	6,795	6,920	97.0	98.0	3,655	3,970	267.0	240.0
77	5,236	5,215	213.0	225.0	2,121	2,240	445.0	450.0
115	3,540	3,408	255.0	270.0	1,618	1,650	520.0	502.0
150	3,100	3,106	300.0	305.0	1,500	1,475	590.0	571.0
175	2,060	1,948	340.0	317.0	1,260	1,205	620.0	602.0

TABLE IV. PERMEABILITY TO LIQUIDS OF EXTRUDED POLYVINYL ALCOHOL AT 77 deg. F.

	Gasoline	Benzene	Ethanol (Anhydrous)	Methanol (Anhydrous)
Pressure above atmosphere	Nil	Nil	Nil	Nil
Permeability, liters per square meter per 24 hours per .01 cm. thickness	.058	.057	.35	4.92
Specific permeability, cubic centimeters per sq. centimeter per centimeter thickness per minute	$.04 \times 10^{-6}$	$.04 \times 10^{-6}$	$.24 \times 10^{-6}$	3.40×10^{-6}

are handled—has resulted in a product of unusual interest. This inertness is impressively demonstrated by the findings of an independent testing laboratory reported in Table II. These tests prove that polyvinyl alcohol plastic is practically unaltered after prolonged immersion in, or exposure to, the materials named in the table. The imperviousness of the polyvinyl alcohol is not limited to the materials listed. Each one was selected because it typified an entire group of chemicals having similar solvent or corrosive characteristics.

Polyvinyl alcohol plastic is not recommended for use with acids or alkalies (excepting certain fatty acids) either in concentrated form or in aqueous solutions. It is not materially affected by the usual impurities found in commercial grades of fuels and oils or other hydrocarbon solvents, including the small percentage of water often present in fuel or oil lines due to condensation or crankcase dilution.

When subjected to oxygen bomb accelerated aging test—300 lbs. oxygen pressure at 160 deg. F. for 240 hrs.—polyvinyl alcohol plastic remained practically unchanged.

Conservative specification and compounding permits the use of polyvinyl alcohol plastics within a temperature range of −55 deg. F. to +275 deg. F., although these limits frequently may be safely extended, depending upon the particular operating conditions (see Table III).

Some of the material used, in both hose and molded shapes, is nearly transparent; some is opaque, although this opacity is not due to the use of inert fillers. It has a specific gravity of approximately 1.26, such lightness often contributing an important feature in use. It can be compounded to have a tensile strength as high as 10,000 lbs. per sq. in., and can be produced in a fairly wide range of softness or hardness. In flexing and vibration tests conducted in the Resistoflex Corp.'s laboratory and in other research and plant control laboratories and in extensive field service, stock samples have stood up for long periods equivalent to the stress of years of actual service, without showing any sign of fatigue.

Independent laboratory tests show that polyvinyl alcohol has an abrasion resistance two to ten times greater than that for rubber or various synthetic substances, and a permeability to organic liquids and gases about $^1/_{30}$th that of rubber (see Tables IV and V).

The maintained smooth inner wall of polyvinyl alcohol tubing, free from tackiness or dissolved tubing particles, insures a dirt-repellent surface and, therefore, an unobstructed flow of the material conveyed. This tubing bends about comparatively short radii, and reveals strong resistance to deformation.

Among the more recently developed products of unusual interest are gloves made of polyvinyl alcohol. Strong, durable, abrasion and tear resistant, these gloves have met immediate approval as a protection against exposure to oils, organic solvents and other skin irritants, many of which constitute serious health hazards. Before the introduction of these gloves, no flexible rubber-like material of sufficient strength and toughness was available which was not in itself attacked by many chemicals. (Fig. 1.)

Continuous research is steadily opening up new fields of application for this material. Profitable consideration may be given to the use of polyvinyl alcohol in the form of hose, tubing, dipped and molded products to be employed with industrial or domestic articles of all kinds. Whether it will be finally classified as a plastic or a rubber is not important. Of major interest is the fact that polyvinyl alcohol fills a long-felt need.

TABLE V. PERMEABILITY TO GASES OF EXTRUDED POLYVINYL ALCOHOL AT 77 deg. F.

	Hydrogen	Oxygen	Acetylene
Pressure, lbs. per sq. in.	26.48	27.25	25.01
Pressure above atmospheric, lbs. per sq. in.	11.77	12.54	10.3
Permeability, liters per sq. meter per 24 hours per .01 cm. in thickness	1.41	.51	2.34
Specific permeability—cubic centimeters per sq. centimeter per centimeter thickness per minute	$.98 \times 10^{-6}$	$.35 \times 10^{-6}$	1.63×10^{-6}
Permeability, liters per square meter per 24 hours per .01 cm. thickness extrapolated to 1 atmosphere	.78	.27	1.38

Molecular weight and solubility of para-toluene sulfonamide-formaldehyde resins

by L. McMASTER and S. S. COOPER*

IN 1934, McMaster[1] prepared condensation products of *p*-toluene sulfonamide with trioxymethylene. His product analyzed to be $(C_8H_9SO_2N)_n$. Molecular weight determinations indicated that n was variable. The method of Rast[2] gave $n = 2$ and 3. Factors of n from 2.5 to 3 were obtained by the freezing point method when phenol and diphenyl ether were used as solvents. Similar results were obtained by the boiling point method, using benzene as the solvent. During the course of this work, considerable data were obtained on the molecular weight of the condensate and not included in the report. We now wish to present these data in more detail. Solubility-temperature relationship of the condensate in benzene was also studied. The results indicate that three phases separate from benzene. Three separate samples of the condensate, crystallized from acetone, ethyl alcohol and toluene, respectively, show essentially the same solubility relations in benzene.

Later, Walter[3] prepared condensation products of aryl sulfonamides with formaldehyde and in the case of the toluene sulfonamides obtained alkali-soluble compounds which could be transformed by heating into alkali-insoluble products which correspond to $n = 2$ and 3. In our method of preparation, the alkali-soluble compound was washed out by 1-percent boiling caustic soda solution. Walter states that the main component formed during the condensation is probably a methylene methylol compound which has a molecular weight of 567, whereas his molecular weight determinations in phenol gave a value of 400. This low result may have been caused by a methylene disulfamide which he claims to have extracted by benzene. This impurity, if formed in our condensations, could not have been present in the material used in our work since the results on that portion crystallized from toluene were similar to those obtained on the portions crystallized from acetone or alcohol.

This condensation product of *p*-toluene sulfonamide with trioxymethylene may be used as a plastic, and since the molecular weights of plastic and near plastic materials are controversial, it was felt that the data obtained on this condensate should be of interest to workers in this field.

* Chemical Laboratories, Washington University, St. Louis, Mo.

[1] McMaster, *J. Am. Chem. Soc.*, 56, 204–206 (1934).
[2] Rast, *Berichte deut. chem. ges.*, 55, 1051 (1922).
[3] Walter, *Trans. Faraday Soc.*, 32, 406 (1936).

Experimental

Molecular Weight Determinations

These were determined in camphor, phenol and naphthalene by the freezing-point-lowering method and in benzene by the method of boiling-point rise. The solvents used were of the highest purity obtainable and constants were determined for each.

In Camphor.—The melting point of the camphor used was 178.6 deg. (cor.) and its cryoscopic constant, using naphthalene as solute, was found to be 39.60 deg. and 39.57 deg. The method of Rast was used with slight modifications. Instead of working in open tubes, samples of camphor and condensate were weighed into small test tubes, the tubes sealed, and the entire mass melted. Melting points were run on portions of this melt in sealed melting point tubes. This method was adopted to prevent loss of camphor by volatilization. The data are recorded in the first four columns in Table I. These values are the average of three or more closely agreeing results, except C-1. One sample, C-1, showed molecular weights of 515 and 199. The higher value was obtained on the first melting whereas the lower value was obtained after the melt had been cooled and reheated. The higher value was thus not reproducible. Several variable results will be found under the solubility data.

In Phenol.—The melting point of the phenol was 41.2 deg. and its cryoscopic constant was 6.90 deg. and 6.99 deg. using naphthalene; 7.12 deg. and 6.89 deg., using phenolphthalein. About 3 or 4 g. of phenol was placed in a weighed thin-walled test tube, $^{8}/_{16}$ in. × 3 in., and about one-half of the material boiled away. The tube was then tightly corked, cooled and accurately weighed. The sample of condensate was then added, the tube reweighed and sealed. The entire content was melted and the mass chilled. The tube was then placed on a piston type agitator immersed in a water bath, the temperature slowly raised and the melting point of the sample determined by use of a Beckmann thermometer. Results are in columns 5 to 8 of Table I.

In Naphthalene.—The melting point of naphthalene was 80.05 deg. and its cryoscopic constant, 6.9 deg. Melting points were determined as with phenol. Results are in columns 9 to 12 of Table I.

In Benzene.—The boiling point of benzene was 80

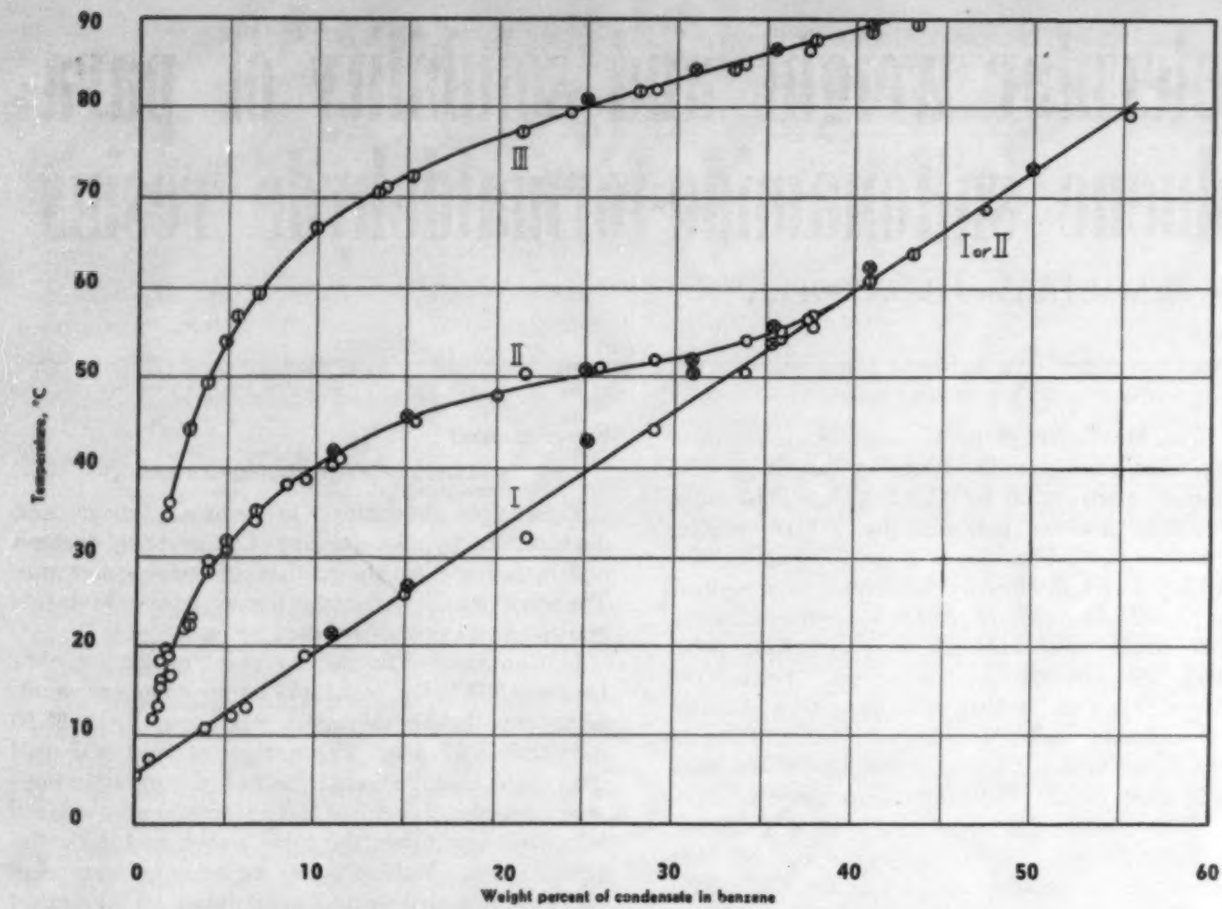


Figure 1. Percent solubility of condensate in benzene as a function of temperature.

- ○ Crystallized from ethyl alcohol
- ⊕ Crystallized from acetone
- ⊗ Crystallized from toluene
- I Phase separating at lower temperature
- II Phase separating at intermediate temperature
- III Phase separating at higher temperature

deg. at 740 mm. Menzie and Wright[4] have determined the molal boiling point rise of benzene as 2.623 deg. with benzil as solute, using the differential water thermometer. The method of Menzie and Wright was used for molecular weight determinations on the condensate using the tables of Menzie[5] for interpolating the differential temperatures before and after addition of the condensate. Results are in the last four columns of Table I.

Solubility Relationships in Benzene

The solubility of the condensate in benzene was determined using the three types of the sample given in Table I. Solubilities below 16 deg. were determined in an open tube. Above 16 deg. the sealed tube method was used. In the latter method, weighed quantities of the condensate and benzene were sealed in a small thin-

[4] Menzie and Wright, *J. Am. Chem. Soc.*, 43, 2314 (1921).
[5] Menzie, *J. Am. Chem. Soc.*, 43, 2309 (1921).

TABLE I

MOLECULAR WEIGHTS OF CONDENSATION PRODUCT OF *p*-TOLUENE SULFONAMIDE WITH TRIOXYMETHYLENE IN DIFFERENT SOLVENTS

By freezing point lowering												By boiling point rise			
In camphor				In phenol				In naphthalene				In benzene			
Type of sample	g. cmpd. / g. solv.	M.W.	n	Type of sample	g. cmpd. / g. solv.	M.W.	n	Type of sample	g. cmpd. / g. solv.	M.W.	n	Type of sample	g. cmpd. / g. solv.	M.W.	n
A	0.096	356	1.94	B	0.101	358	1.95	A	0.126	310	1.69	A	0.0078	469	2.56
"	0.143	358	1.95	"	0.112	359	1.96	"	0.145	364	1.99	"	0.0143	480	2.61
B	0.165	431	2.35	"	0.098	362	1.97	"	0.196	490	2.68	"	0.0212	533	2.91
"	0.073	337	1.84	"	0.066	363	1.98	B	0.213	349	1.91	"	0.0293	562	3.07
"	0.082	353	1.93	"	0.084	365	1.99	"	0.146	352	1.92	B	0.0100	442	2.41
C	0.214	515	2.81	"	0.186	367	2.00	"	0.177	370	2.02	"	0.0177	550	3.00
		199[b]	1.09	"	0.142	426	2.32					"	0.0255	563	3.07
"	0.097	346	1.89	"	0.065	483	2.65					"	0.0361	584	3.18
"	0.138	350	1.91	C	0.157	431	2.35								
"	0.120	516	2.82	"	0.152	455	2.48								
"	0.101	524	2.86	"	0.094	473	2.58								
"	0.081	554	3.02	"	0.110	526	2.87								
"	0.129	557	3.04												

[a] Type A, compound crystallized from acetone; type B, crystallized from ethyl alcohol; type C, crystallized from toluene.
[b] Lower value obtained on remelting.

TABLE II

SOLUBILITY OF CONDENSATION PRODUCT OF *p*-TOLUENE SULFONAMIDE WITH TRIOXYMETHYLENE IN BENZENE

Type* and Weight Percent of Condensate	Temperature of Complete Solution, °C.		
	Type of Crystal		
	I	II	III
A 2.92		22.4	44.5
A 3.86		28.4	49.5
A 5.09		31.5	54.2
A 5.75			57.1
A 6.70		35.1	59.5
A 10.14			66.8
A 13.52			71.1
A 15.25			72.6
A 21.37			77.4
A 27.86			82.2
A 33.33			84.6
A 37.84			87.7
A 41.14		61.0	89.3
A 43.37		64.0	89.6
B 0.83		7.5	
B 1.12		12.1	
B 1.27		13.5	
B 1.44		15.7	
B 1.45		16.3	
B 1.48		18.6	
B 1.65			34.6
B 1.82		20.0	
B 1.84		19.0	36.2
B 1.95		16.9	
B 2.80		22.1	
B 3.07		23.1	
B 4.10		29.7	
B 4.15	11.0		
B 5.01		30.8	
B 5.39	12.4		
B 6.18	13.5		
B 6.60		34.3	
B 7.40		38.4	
B 8.40		38.2	
B 9.42	19.0	38.8	
B 10.88		40.3	
B 11.35		41.1	
B 13.84			71.3
B 15.03	26.0		
B 16.12		45.0	
B 20.09		48.0	
B 21.85	32.1	50.1	
B 24.15			79.7
B 25.63	39.5	51.1	
B 29.00	44.2	52.5	82.2
B 33.88	50.6	54.2	84.8
B 36.10	54.6	55.2	
B 37.46	55.7	55.7	86.7
B 37.58	56.6		
B 37.71	56.8	55.8	
B 47.37	68.		
B 55.35	79.5		
C 10.96	21.6	42.0	
C 15.17	26.9	45.7	
C 25.18	43.0	51.0	81.2
C 31.18	50.5	52.0	84.6
C 35.55	54.0	56.2	86.8
C 40.85	62.5		89.5
C 50.00	73.5	73.5	

* Type A, compound crystallized from acetone; type B, crystallized from ethyl alcohol; type C, crystallized from toluene.

walled test tube which was placed on the piston type agitator in a water bath. As the tube and its contents were vigorously shaken, the temperature of the bath was slowly raised and the temperature at which the last crystals of the condensate disappeared was noted on a calibrated 0.1 deg. thermometer. From the solubility data thus obtained, it is shown that at least three phases of the condensate separate from benzene. These phases may be polymeric or polymorphic forms or solvated molecules. Without attempting to identify them the phase separating at the lower temperature will be designated as I, that separating at the intermediate temperature as II, and the one at the higher temperature as III. The solubility curves were established as follows. The temperature of complete solution was determined as described above. This solution was then chilled, causing the separation of very fine crystals. The temperature of the sample was again slowly raised and a new solution temperature obtained. In most every case, this resulted in II, occasionally in III. This solution was chilled again and kept cold (about 0 deg.) for two to twenty minutes. The temperature was again raised until the solution temperature was reached. This resulted in III. On a number of samples, II was just dissolved and the solution kept at this temperature for one to ten minutes with violent agitation. This caused the formation of fine needle-like crystals of III, the entire contents of the tube eventually becoming solid. Heating from this temperature gave solution points for III. Results are tabulated in Table II and are plotted in Fig. 1 as percent by weight of the condensate against temperature of complete solution.

Discussion of Results

That the condensation product of *p*-toluene sulfonamide with trioxymethylene may exist in more than one form is born out by molecular weight determinations. Examination of Table I shows that n of the formula $(C_8H_9SO_2N)_n$ is variable. Besides values of $n = 1, 2$ and 3 it will be noted that in each of the solvents, values of n between 2 and 3 were obtained. In camphor one sample gave a molecular weight of 199 and 515 corresponding to $n = 1.09$ and 2.81. The higher molecular weight in this case was obtained on the first heating and the lower value after the sample had been cooled and reheated.

The condensate appears to behave similarly in camphor and phenol. In these two solvents $n = 1, 2$ and 3 with values intermediate between 2 and 3. In naphthalene n appears to be mainly 2; however, a value between 1 and 2 and one between 2 and 3 was obtained. Since the freezing point temperatures in the three solvents mentioned are so far apart, it could scarcely be assumed that the variation in n could be an effect of temperature alone. There also seems to be no essential difference between the material crystallized from different solvents. The results in different solvents indicate polymerization or deviation from the perfect solution laws or both. Although (*Please turn to page 96*)

Plastics Digest

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastics materials or use them. Requests for copies of the magazines mentioned should be directed to the individual publishers whose addresses will be mailed upon receipt of a self-addressed stamped envelope.

General

TEXTILE FABRIC FROM SEAWEED. Chemical Age *43*, 238 (Nov. 23, 1940). Seaweed contains from 20 to 30 percent alginic acid. Filaments formed by forcing a viscous solution of this material through spinnerets have a silk-like finish and are rendered insoluble in alkalies by a process not yet disclosed.

INDUSTRIAL RESEARCH IN 1940. W. A. Hamor. News Edition A.C.S. *19*, 1–16 (Jan. 10, 1941). Advances in plastics, synthetic fibers, protective coatings, synthetic rubbers and other industrial products are reviewed. The writer notes that "Plasticians are happily in tune with industry and find pleasure and profit in observing the nuances of commerce."

NEW PLASTIC PLANE. Business Week *1941*, 36–7 (Jan. 11). The newest plastic plane built by the Summit Aeronautical Corp. under the Vidal process patents is ready for flight testing. It is a two-place 1350-lb. job with low wings, fuselage and tail all molded of plywood bonded with vinyl butyral resin. Another molded airplane is expected to be finished soon by the Duramold Aircraft Corporation which has modified considerably the process used in molding the first Clark plane.

CELLULOSE FROM HARDWOODS. G. A. Richter. Ind. Eng. Chem. *33*, 75–83 (Jan. 1941). The hardwoods described include the birches, maples and beech, such as are prevalent in the northeastern states. They are more dense and contain more cellulose per cord of stacked wood than do the conifers. This article presents data concerning the composition of these woods.

CELLULOSE DERIVATIVES AS BASIC MATERIALS FOR PLASTICS. Emil Ott. Ind. Eng. Chem. *32*, 1641–7 (Dec. 1940). A discussion of the role and significance of cellulose derivatives in the plastics industry. The effects of molecular shape and size, substitution in the cellulose molecule, and plasticizers on the properties of cellulose plastics are surveyed.

Materials and Manufacture

PROTEIN PLASTICS FROM SOYBEAN PRODUCTS. LAMINATED MATERIAL. G. H. Brother, L. L. McKinney, and W. C. Suttle. Ind. Eng. Chem. *32*, 1648–51 (Dec. 1940). A protein laminated plastic prepared from unsized kraft paper impregnated with formaldehyde-hardened thermoplastic soybean protein salt compared favorably with similar commercial materials as regards impact and flexural strength and modulus of elasticity, but not as regards water resistance. By placing a single sheet of phenolic- or urea-resin-impregnated paper on each exposed face before pressing, a product resulted with the water resistance and other desirable properties of commercial laminated products, except for the edges, in considerably reduced time of pressing.

THERMOPLASTIC BEHAVIOR OF LINEAR AND THREE - DIMENSIONAL POLYMERS. S. S. Kistler. J. Applied Physics *11*, 769–78 (Dec. 1940). Thermoplasticity of the linear polymers is shown to have an intimate connection with the character of the side groups on the long chain molecules. The ultimate tensile strength of three-dimensional polymers is dependent primarily upon secondary forces and has little relation to the degree of cross linking. The cross linking mainly influences the amount of extension and the amount of plastic deformation.

LAMINATED PLASTICS FOR AIRCRAFT PARTS. S. W. Place. Aero Digest *38*, 122–5–8, 131 (Jan. 1940). The available grades and forms of laminated plastics are listed and the properties of these materials are discussed.

POLYMERS FROM OLEFINES. L. Light. Chemical Age *43*, 240 (Nov. 23, 1940). A review of patents relating to technical developments and industrial uses of polymers and copolymers of olefines and diolefines.

Applications

PLASTICS FOR "STOPPING-OFF" PLATING JIGS. E. E. Halls. Plastics *4*, 201–2 (Sept. 1940). Electroplating involves the handling of articles to be coated successively through a number of chemical operations. Wires, jigs, and racks for conveying the articles must be suitably protected from contact with very corrosive fluids. Rubber hydrochloride applied by a dipping process effectively meets the requirements for this job.

PLASTICS BIBLIOGRAPHY FOR AIRCRAFT ENGINEERS. J. Aeronautical Sciences, Aero. Review Sec. *8*, 39, 41, 43 (Nov. 1940). References pertaining to the specialized field of the applications of plastics in aircraft parts and structures are listed.

DEVELOPMENT OF SUBSTITUTES FOR FOREIGN TEXTILES USED IN PARACHUTES. J. Miller. Textile Colorist. *62*, 820–3 (Dec. 1940). The parachute which has always been considered as essentially a life-preserving medium has evolved into a significant offensive weapon. As it is constructed almost entirely of linen and silk, fibers of foreign origin, the necessity of developing substitutes fabricated from domestic or synthetic fibers is a prime requisite of national defense. The construction of the standard military parachute is described and the development work under way to utilize fibers made of synthetic resins and cellulose derivatives is discussed.

WINDOWS IN WAR-TIME. H. Moore, Brit. Plastics *12*, 192,201 (Nov. 1940). Methods of protecting windows to prevent injuries from broken glass are described. The use of sheets and coatings of plastics is quite effective.

Properties and Testing

TRANSMISSION AND REFLECTION OF PLASTICS AND METAL BLACKS IN THE FAR INFRARED. H. S. Seifert and H. M. Randall. Rev. Sci. Instr. *11*, 365–8 (Nov. 1940). Polystyrene is more transparent in the far infrared than are methacrylate resins. While the transparency of the rubber latex and hydrochloride equals that of polystyrene, the mechanical rigidity of the polystyrene makes it more suitable for transparent windows in vacuum spectrographs and absorption cells. Measurements are also reported for cellulose nitrate and phenolic resin.

OPTICAL UTILITY OF ORGANIC GLASSES. Kurt Frölich. Kunststoffe *30*, 267–73 (Sept. 1940). The dispersion characteristics, light transmission in the ultraviolet, visible and infrared regions, homogeneity and stability toward ultraviolet light and heat are reported for many types of transparent plastics. These properties are of importance in the selection of materials for lenses.

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TENITE SPANS THE CONTINENT on many air lines in the form of airplane interior appointments. It is sturdy, yet light in weight, fulfilling a major requirement of the aviation industry.

The hornlike strength and toughness of Tenite allow weight reduction to a minimum by making thin-walled sections possible—sections that can be securely riveted, cemented, or fitted by friction into an assembly. The surface of Tenite moldings is smooth and lustrous. It will not tarnish or become dull with wear. Color is an integral part of the plastic and cannot chip or peel off.

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U. S. Plastics Patents

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PLASTICIZED RESIN. H. W. Lawson and J. L. Gillerlain (to A. E. Starkie and O. Eisenschiml). U. S. 2,217,988, Oct. 15. Plasticizing an organic resin with the heavy naphthenic and aromatic hydrocarbon oils extracted from heavy crudes with such solvents as furfural, phenol, dichloroethyl ether or nitrobenzene.

NITROGENOUS RESINS. W. Zerweck and K. Keller (to General Aniline and Film Corp.). U. S. 2,218,077, Oct. 15. Colorless waterproof heat-stable resins suitable for electric insulation, lacquers, adhesives and molding compositions are made by condensing formaldehyde, acetaldehyde or propionaldehyde with heterocyclic bases.

LOW TEMPERATURE PLASTIC. R. E. Fothergill (to E. I. du Pont de Nemours and Co.). U. S. 2,218,146, Oct. 15. A plastic which is still extremely tough even when chilled to 0°F. comprises cellulose acetate propionate plasticized with tributyrin.

STATIC ELECTRICITY GUARD. J. C. Patrick (to Thiokol Corp.). U. S. 2,218,176, Oct. 15. Surfaces in contact with moving objects which generate static electricity are protected from static charges by a covering of polymerized disulphide along the contact surface.

EMBOSSING PLASTICS. Douglas F. Winnek. U. S. 2,218,227, Oct. 15. Embossing cellulose acetate or other thermoplastic sheeting by passing the sheet over a hot roll and then over an engraved cold roll.

TRANSLUCENT PLASTICS. C. L. Fletcher and G. A. Kirton (to Eastman Kodak Co.). U. S. 2,218,235, Oct. 15. Preparing finely comminuted cellulose for use as a filler in uniformly translucent plastic compositions.

ACETAL RESIN SHEETS. J. J. Gordon (to Eastman Kodak Co.). U. S. 2,218,237–8–9, Oct. 15. Using diethyleneglycol benzoate butyl ether, methoxyethyl maleate or diisoamyl maleate as plasticizer or elasticizer in rubbery transparent sheeting made of polyvinyl acetal resins.

ACETAL RESIN. Henry B. Smith (to Eastman Kodak Co.). U. S. 2,218,251, Oct. 15. Plasticizing polyvinyl acetal resins with diglycerol tetrapropionate.

THICKENING GELATIN. W. J. Weyerts and C. W. Wiederhold (to Eastman Kodak Co.). U. S. 2,218,255, Oct. 15. Increasing the viscosity of photographic gelatin by adding polyvinyl phthalate.

RESIN ACID PRODUCT. A. G. Hovey and T. S. Hodgins (to Reichholds Chemicals, Inc.). U. S. 2,218,284, Oct. 15. Condensing free abietic acid with pyridine to form a resin.

METHACRYLATE INTERPOLYMERS. H. W. Starkweather and A. M. Collins (to E. I. du Pont de Nemours and Co.). U. S. 2,218,362, Oct. 15. Making rubber-like products by emulsion interpolymerization of butadiene and methyl methacrylate.

REFRIGERATOR INSULATION. G. Alexander (to General Electric Co.). U. S. 2,218,373, Oct. 15. Insulating strips for refrigerators are formed of laminated fabric in which the binder is a phenolic resin.

ELECTRIC INSULATION. W. Schulze (to General Electric Co.). U. S. 2,218,385, Oct. 15. Swelling polystyrene in acetone, applying product to electric wire and removing swelling agent.

POLYESTERS. H. S. Rothrock (to E. I. du Pont de Nemours and Co.). U. S. 2,218,439, Oct. 15. Polymerizing dimethallyl adipate to a resin in presence of benzoyl peroxide.

RESIN BLEND. L. P. Moore (to American Cyanamid Co.). U. S. 2,218,474, Oct. 15. A fast-curing film former for light-fast finishes contains a blend of oil acid modified alkyd resin and aminotriazine-aldehyde resin.

OIL-SOLUBLE RESIN. Israel Rosenblum. U. S. 2,218,553, Oct. 22. Making oil-soluble alkyd resins from glycerol, oil acids and maleic or succinic acid.

RUBBER HYDROCHLORIDE. J. H. McKenzie (to Marbon Corp.). U. S. 2,218,617, Oct. 22. Dissolving amorphous rubber hydrochloride in an aromatic hydrocarbon solvent and inhibiting gelation by adding a nonsolvent ketone.

VINYL CHLORIDE RESIN. A. B. Japs (to B. F. Goodrich Co.). U. S. 2,218,645, Oct. 22. Incorporating an alkali metal phosphate in plasticized gamma polyvinyl chloride.

ABRASIVES. C. E. Barnes (to Norton Co.). U. S. 2,218,782, Oct. 22. Bonding abrasive grains with a styrene and acrylic, chloroacrylic or methacrylic acid interpolymer.

ABRASIVE SHAPES. S. S. Kistler and C. E. Barnes (to Norton Co.). U. S. 2,218,795, Oct. 22. Pouring a polymerizable compound over abrasive grains in a mold, heating without pressure to set the polymer, and stripping the abrasive articles from the mold.

SPLINTS. S. P. Lovell (to Castex Laboratories, Inc.). U. S. 2,218,844, Oct. 22. Impregnating fibrous webs with a resin and applying the product in layers to an injury so that the resin will harden and form a splint.

PLASTIC FROM WOOD. Viktor Skutl. U. S. 2,218,897, Oct. 22. Steaming wood under high pressure to destroy its fibrous structure and shaping the product into moldings with low moisture and ash content.

REFLECTORS. E. R. Gill, Jr. (to Prismo Holding Corp.). U. S. 2,218,909, Oct. 22. Partially embedding synthetic resin reflecting elements in a synthetic resin binder.

BEARING. J. V. O. Palm, J. K. Anthony and J. E. Wilkey (to Cleveland Graphite Bronze Co.). U. S. 2,219,054, Oct. 22. Reinforcing a synthetic resin bearing with glass fiber and another heat repelling material.

CASEIN PRODUCT. K. Memminger (to Fahlberg-List Aktiengesellschaft Chemische Fabriken). U. S. 2,219,369, Oct.

Ethocel

TEST

A single injection molding, designed in The Dow Chemical Company's laboratories, permits a study of the behavior of ETHOCEL* plastic granules in the press and provides uniform test pieces for the evaluation of the material. This test molding, which finds important use in determining the formulation of ETHOCEL plastics, shows the fine combination of excellent properties available in this single material. It is used to control and check each lot of ETHOCEL plastic produced.

ETHOCEL has many important characteristics which make it the ideal plastic material.

- ETHOCEL plastics have good resistance to *low temperature impact.*
- The *dimensional accuracy of* ETHOCEL means less mold shrinkage—elimination of sinks and pockets.
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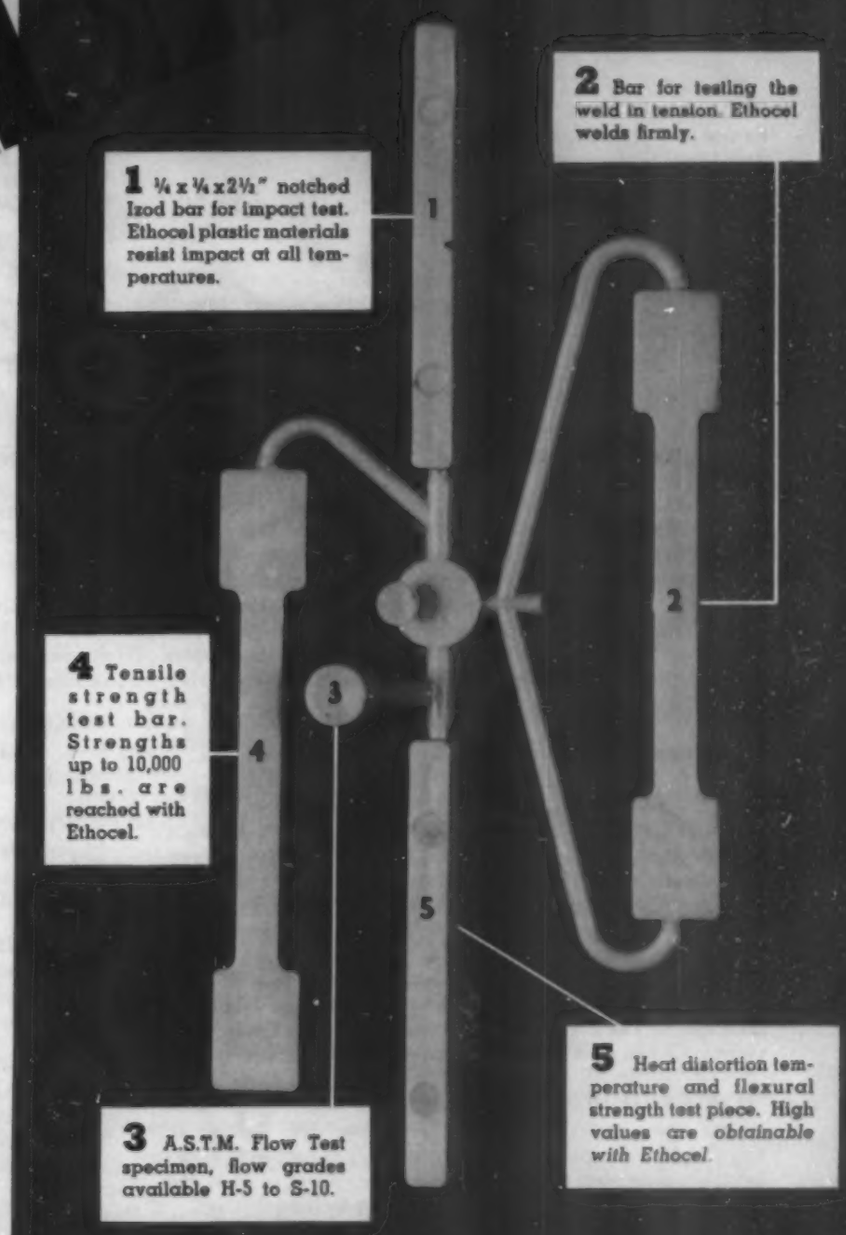
Ask for a demonstration of ETHOCEL's properties before completing your plans for any of the following: (1) Injection molding plastics, (2) Extrusion molding plastics, (3) Compression molding plastics.



1 ¼ x ¼ x 2½" notched Izod bar for impact test. Ethocel plastic materials resist impact at all temperatures.

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29. Dissolving *p*-toluenesulphonamide and casein in caustic potash solution and condensing the product with formaldehyde.

SAFETY GLASS. W. Starck and W. Heuer (to General Aniline and Film Corp.). U. S. 2,219,433, Oct. 29. Vinyl ester resins, formed by polymerization in presence of fatty acid peroxides, are used as interlayers in shatterproof glass.

COMPOSITE PRODUCT. F. Groff (to Union Carbide and Carbon Corp.). U. S. 2,219,447, Oct. 29. Bonding a vinyl ester resin to thermosetting phenolic resin under heat and pressure with the aid of a fibrous absorbent serving to improve adhesion.

STABILIZED RESIN. V. Yngve (to Carbide and Carbon Chemicals Corp.). U. S. 2,219,463, Oct. 29. Stabilizing polyvinyl chloride with an aryl or arylalkyl lead or tin compound.

CORK PRODUCT. S. M. Martin, Jr. (to Thiokol Corp.). U. S. 2,219,550, Oct. 29. Coating compressed cork with a plastic formed from a polysulphide and an organic dichloride, to form a flexible material.

PRINTING PLATES. C. E. Boutwell. U. S. 2,219,587, Oct. 29. Forming relief printing plates from lead carbonate or iron oxide and a plasticized cellulose derivative.

ELASTIC RESIN. E. Schnabel (to Resistoflex Corp.). U. S. 2,219,661, Oct. 29. Making a rubber-like product by treating a polyacrylate ester resin in solution with a copper compound.

SAFETY GLASS. E. W. Fawcett, R. O. Gibson and M. W. Perrin (to Imperial Chemical Industries, Ltd.). U. S. 2,219,684, Oct. 29. Using a polyethylene resin as interlayer in safety glass.

MOISTUREPROOF FOIL. M. W. Perrin, J. G. Paton and E. G. Williams (to Imperial Chemical Industries, Ltd.). U. S. 2,219,700, Oct. 29. Forming foils which are inherently moistureproof by shaping a solid polymer of ethylene.

ACRYLATE RESIN. W. Bauer and F. Esser (to Röhm and Haas Co.). U. S. 2,220,033, Oct. 29. Interpolymerizing acrylonitrile, methacrylic amide and an alkyl methacrylate (not higher than butyl methacrylate).

Ed. Note: Patents issued between Nov. 5th and Dec. 3 will be found in the January 1941 MODERN PLASTICS.

GRINDING LENSES. E. D. Tillyer and H. R. Moulton (to American Optical Co.). U. S. 2,224,168, Dec. 10. Lenses molded from methyl methacrylate are ground with an abrasive composed of resin particles having a lower softening point than that of the lens, these particles being embedded in beeswax.

SAFETY GLASS. C. S. Shoemaker (to American Window Glass Co.). U. S. 2,224,236, Dec. 10. In making laminated glass one face of a glass sheet is brushed clean, subjected to a vacuum and covered with a film of interlayer material.

LINOLEUM. D. H. Spitzli and R. L. Kennedy (to Congoleum-Nairn, Inc.). U. S. 2,224,237-8, Dec. 10. Converting a drying or semidrying oil to linoxyn which is at least 80% ether-insoluble, dispersing particles of linoxyn in binder of resin and oxidized drying oil and molding composition to form flooring.

RESILIENT TEXTILE FIBERS. D. Finlayson and R. G. Perry (to Celanese Corp. of America). U. S. 2,224,293, Dec. 10. Imparting increased resilience to textile fibers and fabrics by treatment with a urea-formaldehyde resin intermediate in aqueous dispersion followed by heating to set the resin.

VARNISH RESIN. Israel Rosenblum. U. S. 2,224,359, Dec. 10. Condensing phenol with formaldehyde in presence of a reaction product of dipentene and silicon chloride and leaching the resin to remove silicon.

FLAKE MICA SHEETS. A. Runyan (to Continental-Diamond Fibre Co.). U. S. 2,224,523, Dec. 10. Use of a cellulose ether or ester binder in making a laminated sheet product from mica flakes.

ACETAL RESIN. H. Berg and A. von P. Reybegg (to Chemische Forschungsgesellschaft m. b. H.). U. S. 2,224,663, Dec. 10. Mixed polymers are formed by polymerizing a vinyl ester, ether or halide in a solution of a polyvinyl acetal.

BONDING RUBBER TO RAYON. A. Hershberger (to E. I. du Pont de Nemours and Co.). U. S. 2,224,679, Dec. 10. Rayon tire cord is bonded to rubber in the tire by an insoluble, infusible tannin-aldehyde resin.

CARBON BRUSH. H. M. Elsey (to Westinghouse Electric and Mfg. Co.). U. S. 2,224,724, Dec. 10. Impregnating a carbon brush with a volatile-free phenol-formaldehyde resin, setting the resin by heat, impregnating with a solution of an alkyd resin and again setting the resin by heat.

SILICA RESINS. E. Glycofrides (to Owens-Illinois Glass Co.). U. S. 2,224,815, Dec. 10. Condensing phenol with formaldehyde in presence of silicic acid to form a resin containing dispersed silica.

POLYSTYRENE. L. Rosenthal and H. Meis (to I. G. Farb. Akt.). U. S. 2,224,837, Dec. 10. Polymerizing styrene in acid medium in presence of a phenol or phenol ether.

PLASTICIZER. S. L. Bass, T. A. Kauppi and C. L. Moyle (to Dow Chemical Co.). U. S. 2,224,847, Dec. 17. Plasticizing cellulose ethers with a triaryl phosphate in which the 3 aryl radicals carry at least 4 cycloalkyl, tertiary alkyl or aryl substituents.

MOLDING POLYSTYRENE. R. D. Lowry (to Dow Chemical Co.). U. S. 2,224,852, Dec. 17. Charging a mold with styrene resin covering less than half the mold area but capable of filling the mold cavity.

NAPHTHYL ETHER RESIN. K. Folkers (to Merck and Co.). U. S. 2,224,865, Dec. 17. Dehydrating a hydrogenated naphthol to form a hydrogenated naphthyl ether resin.

MOLDING PULP. E. M. Paterson and R. O. Wilson (to Plastic Fibre Corp.). U. S. 2,224,881, Dec. 17. In a press for molding articles from fibrous pulp the pressing chamber is formed by two sliding hollow forms which form a sealed chamber.

VINYLIDENE RESIN COATING. G. H. Young (to Stoner-Mudge, Inc.). U. S. 2,224,944, Dec. 17. Heat-stable coatings containing polymerized vinylidene chloride stabilized with a heterocyclic nitrogen base.

RESIN-IMPREGNATED SHEET. L. T. Sutherland (to Barrett Co.). U. S. 2,224,992, Dec. 17. A continuous process for impregnating a fibrous web with thermosetting resin, removing solvent, curing treated web in contact with another fibrous web, impregnating one web in the assembly with glycerol.

STRAWS. J. W. Welsh (to Welsh Mfg. Co.). U. S. 2,225,-026, Dec. 17. Forming tubes of pyroxylin or other cellulose derivative by forming a step in opposite surfaces of a strip of the material, winding strip helically and welding where edges meet.

COIL INSULATION. J. J. Connors (to Harvel Corp.). U. S. 2,225,034, Dec. 17. Adjacent turns of an electric coil are supported but held separate by a solvent-free infusible resin, formed in the coil by reaction of shellac with cashew nut shell liquid residues.

(*Please turn to next page*)

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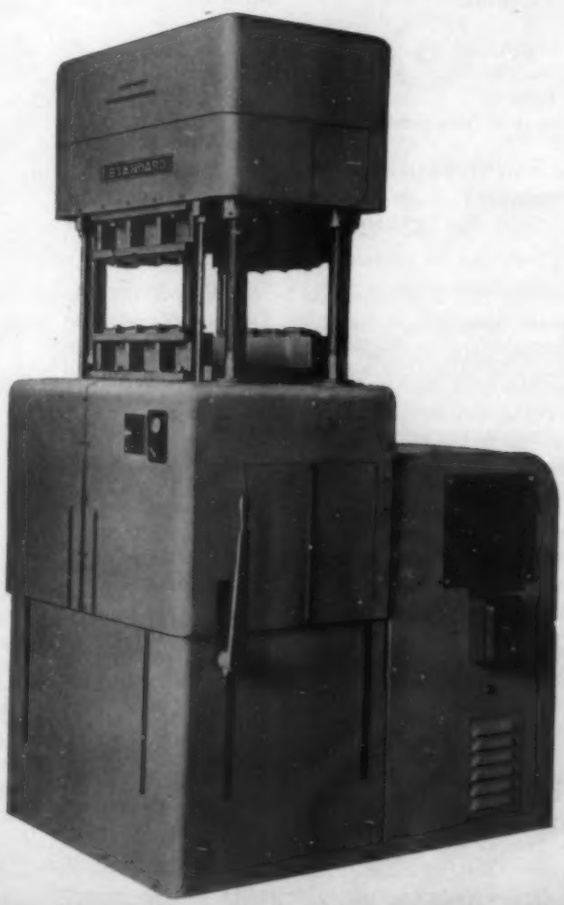

In button manufacture it is customary to use preforms substantially heavier than the finished buttons . . . to allow for flash-surge from the cavities which occurs when pressure is applied rapidly, particularly in worn molds. The new "Standard" Semi-Automatic Press, with its precise, automatic control of final closing speed and pressure, enables preforms of almost exact weight to be used.

The mold is closed the final fraction of an inch very slowly, timed exactly to the plasticizing action of the material. There is little tendency toward surge . . . practically no flash to remove. *Savings in material run as high as 20%.*

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F.J.Stokes MOLDING EQUIPMENT

FJS Est. 1895

COATING. Wm. P. Colio (to E. I. du Pont de Nemours and Co.). U. S. 2,225,256, Dec. 17. Compounding a heat-hardening urea resin with 0.05 to 4.5 percent of chlorinated rubber for use in coatings.

WOOD FILLER. J. B. Dietz and E. F. Oeffinger (to E. I. du Pont de Nemours and Co.). U. S. 2,225,262, Dec. 17. Use of a drying oil modified alkyd resin a siliceous filler, a solvent and a drier in a wood finishing filler.

HETEROPOLYMERS. F. E. Frey, R. D. Snow and L. H. Fitch, Jr. (to Phillips Petroleum Co.). U. S. 2,225,266, Dec. 17. Forming high molecular weight heteropolymers by action of sulphur dioxide on ethylacetylene, phenylacetylene, vinylacetylene, divinylacetylene or polyvinylacetylene.

VARNISH-RESIN COPOLYMER. R. B. Flint and H. S. Rothrock (to E. I. du Pont de Nemours and Co.). U. S. 2,225,534, Dec. 17. Interpolymerizing styrene with a preformed varnish composed of resin and a frosting drying oil.

ALKYD RESIN COATING. A. Siegel (to E. I. du Pont de Nemours and Co.). U. S. 2,225,664, Dec. 24. A durable alkyd resin finish is pigmented with a nonbleeding manganese lake of an azo dye.

MOLDING PLASTICS. C. C. Webb (to Wheeling Stamping Co.). U. S. 2,225,672, Dec. 24. A press having a multiple mold and a belt carrying a stripper for removing articles from the mold.

SOAP SHEET. C. S. Rowe (to E. I. du Pont de Nemours and Co.). U. S. 2,226,075, Dec. 24. Soap in sheet form, with a water-dispersible polyvinyl compound as carrier.

UREA RESIN. A. Hill and E. E. Walker (to Imperial Chemical Industries, Ltd.). U. S. 2,226,202, Dec. 24. Products of two alkaline condensations of formaldehyde (one with urea and the other with a carbamate ester) are caused to react in propyl, butyl or amyl alcohol or in a glycol ether to form a resin.

THREADED MOLDINGS. A. A. Scott (to Wheeling Stamping Co.). U. S. 2,226,326, Dec. 24. A mechanism for unscrewing screw-threaded molded articles from their molds.

MOLDING THERMOPLASTICS. Leo Nast (to New Brunswick Die Molding Corp.). U. S. 2,226,408, Dec. 24. A press for molding thermoplastics has two form members capable of engaging each other in either of two positions.

THERMOPLASTICS. Graydon Smith and Albert Allen (to Reed-Prentice Corp.). U. S. 2,226,446, Dec. 24. Effecting uniform heating of a thermoplastic, prior to molding, by heating the walls of the conduit through hysteresis induced by a varying electromagnetic field.

UREA RESINS. T. S. Hodgins and A. G. Hovey (to Reichhold Chemicals, Inc.). U. S. 2,226,518, Dec. 24. Making a stable hydrocarbon-soluble resin by boiling dimethylolurea with butanol and dehydrating the product in vacuum.

ISOBUTYLENE POLYMERS. Wm. H. S. Smyers (to Standard Oil Development Co.). U. S. 2,226,589-90, Dec. 31. Use of polyisobutylene (molecular weight above 1000) for cementing metal foil to paper; or higher polymers (molecular weight above 2000) as a compounding ingredient in rubber insulation for electric wires.

STYRENE RESIN. S. G. Foord (to International Standard Electric Corp.). U. S. 2,226,714, Dec. 31. Stabilizing polystyrene with 0.05 percent or less of quinone.

HALIDE RESINS. R. R. Dreisbach (to Dow Chemical Co.). U. S. 2,226,809, Dec. 31. Polymerized nucleus-fluorinated styrene derivatives as new synthetic resins.

CELLULOSE ETHER. E. L. Kropscott (to Dow Chemical Co.). U. S. 2,226,823, Dec. 31. Plasticizing water-soluble cellulose ethers with a water-soluble tetrahydric, pentahydric or hexahydric alcohol.

PRINTED SHRINK CAPS. R. T. K. Cornwell (to Sylvania Industrial Corp.). U. S. 2,226,848, Dec. 31. Plasticizing shrink caps, printing thereon with a drying oil or synthetic resin ink containing a hard resin to prevent tackiness, and aging the product before use.

PLASTICIZERS. C. Ellis (to Standard Oil Development Co.). U. S. 2,227,128, Dec. 31. Plasticizing cellulose esters or ethers with a formal of a 1,2-nitrohydroxyparaffin.

PLASTICIZED VINYL RESIN. J. J. Russell (to General Electric Co.). U. S. 2,227,154, Dec. 31. Plasticizing polyvinyl chloride with dibenzyl adipate or higher homologs thereof to form a resin with good tensile strength, cold flexibility and low plasticizer loss.

VINYL RESIN EMULSIONS. W. Starck and H. Freudenberger (to General Aniline and Film Corp.) U. S. 2,227,163, Dec. 31. Emulsion polymerization of vinyl chloride in an aqueous solution of polyvinyl alcohol.

ABRASIVE. N. P. Robie (to Carborundum Co.). U. S. 2,227,200, Dec. 31. An ethenoid resin, having organic acid groups to make it soluble in dilute alkali, is used as binder for abrasive grains.

LAMINATED FABRIC. Leo Beck (to Catalin Corp.). U. S. 2,227,212, Dec. 31. Bonding a thermosetting resin to a fabric base by a layer of a thermoplastic resin which prevents the thermosetting resin from penetrating the fabric.

PHENOL-AMINE-ALDEHYDE RESIN. E. F. Fiedler (to General Electric Co.). U. S. 2,227,219, Dec. 31. Condensing a phenol with lignin and formaldehyde and reacting the product with an amine.

UREA RESIN. T. S. Hodgins and A. G. Hovey (to Reichhold Chemicals, Inc.). U. S. 2,227,223, Dec. 31. Condensing urea with formaldehyde in alkaline solution in presence of butanol, acidifying with phosphoric acid and distilling off butanol and water.

WRAPPER FOR FROZEN FOODS. C. W. Vogt (to Owens-Illinois Glass Co.). U. S. 2,227,236, Dec. 31. Use of chlorinated rubber foil, reinforced with paper, as a wrapper for frozen foods.

INJECTION MOLDING. E. R. Knowles (to Watson-Stillman Co.). U. S. 2,227,263, Dec. 31. A head for an injection molding machine has a central inlet bore and several branch bores radiating therefrom, with injection nozzles for each.

MOLDING PRESS. J. Lauterbach (to Watson-Stillman Co.). U. S. 2,227,265, Dec. 31. A hydraulic press with fixed and movable vertical platens, a movable horizontal platen and a reciprocable subplaten.

SULPHURIZED OILS. Herman B. Kipper. U. S. 2,227,311, Dec. 31. Making plastics by sulphurizing unsaturated hydrocarbon oils in presence of olefins, aldehydes and antimony sulphide.

BEARD STIFFNER. Arthur D. Robson. U. S. 2,227,321, Dec. 31. An aqueous alcohol dispersion of a water-soluble cellulose ether for application to the face prior to dry-shaving.

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As part of his training in Molding at Plastics ITI, each student operates these modern presses, making a variety of molded products just as he would in a commercial plant.

This is only one practical phase of Plastics ITI instruction which also includes the principles of the operation and maintenance of compression and extrusion presses. Also included is the study of molding materials and their properties, preparation of materials for molding, full and semi-automatic molding, heat and pressure developing means, accessories for molding, plant layout, finishing operations and inspection.

Each phase of plastics training is dealt with in an equally complete and practical manner at the Institute, rounding out a comprehensive course of training. The history of materials, types and characteristics, physical, electrical and chemical properties, mold design, molding, laminating, fabricating, marketing and sales, together with methods of testing and research form a part of the curriculum.

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Publications

Write direct to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices

The Ring Index

by A. M. Patterson and L. T. Capell
American Chemical Society Monograph No. 84
Reinhold Publishing Corp., 330 W. 42nd St., New York, 1940

Price $8.00 **661 pages**

The ring index is a collection of known parent ring systems of organic compounds, arranged in order from the simplest to the most complex. The rules for numbering atoms in these ring systems, directions for using the ring index, citation of the original reference for each structure, and a comprehensive name index make this book extremely valuable to the organic chemist. The magnitude of this work as well as the pace at which organic chemistry has been travelling in the early years of its second century may be realized from the fact that the number of known ring systems increased from an estimated 800 to 1000 in 1922, at which time the preparation of this index was started, to about 4000 at present. G. M. K.

Handbook of Chemistry and Physics—24th Edition

Charles D. Hodgman, Editor-in-Chief
Chemical Rubber Publishing Co., Cleveland, Ohio, 1940

Price $3.50 **2582 pages**

Mere listing of the appearance of a new edition of this well-known authoritative and comprehensive source of classified scientific data would be sufficient here, were it not for noteworthy revisions and additions made in accordance with the established policy of its editors and publishers. The physical constants of organic compounds have been presented in convenient tabular form this year with retention of the cross-referencing feature of previous editions. A new table listing the physical constants of industrial organic compounds has been added. The compilation of properties of commercial plastics has been revised and extended to include types not available when the original table was prepared. Other sections have been reviewed and modified to provide in convenient form up-to-date information in the fields of chemistry, physics, and mathematics. G. M. K.

Salesmen Built America

by George A. Hughes
Dartnell Corp., 4660 Ravenswood Ave., Chicago, Ill., 1941
Price $1.50 **95 pages**

A collection of short essays built around the premise contained in the title. If Washington, Jefferson, Lincoln, Columbus, the Pilgrim fathers, et al., were salesmen, the proposition is sound. It's as good a way of looking at history as any other monolateral frame of reference, but no better. The essays are anecdotal in style, are interestingly written. Each makes a point, albeit it sometimes gets a bit stretched in the making. Example: Mr. Hughes, who is Chairman of the Board of the Edison General Electric Appliance Company, tries to prove that one shouldn't argue with customers by citing the very successful arguments of Wendell W. Willkie with the Tennessee Valley Authority. The point may be well taken, but the example would not prove it. Other essays are better pointed. It is a light, chatty little book. It makes no pretensions and lives up to that promise. W. S. R.

● A NEW 32-PAGE, ILLUSTRATED BOOKLET, ENtitled *Bakelite Molding Plastics*, has just been published by Bakelite Corp., Unit of Union Carbide and Carbon Corp. This booklet contains descriptions of compression and injection molding processes and explains the essential differences between thermosetting (hot-set) and thermoplastic (cold-set) molding materials. The physical, mechanical and electrical properties and characteristics of Bakelite phenolics, ureas, polystyrenes and acetates are enumerated in editorial and table form so as to give the reader an understanding of how these materials can be employed. Four studies in full color emphasize the unlimited, pleasing color possibilities of molded plastics for modern color styling. Copies are available to business executives upon request to the company at 30 East 42nd St., New York.

● HOW TO APPLY RADIANT HEAT LAMPS TO INDUStrial drying, baking and heating tasks is told in a new 12-page illustrated booklet published by the Westinghouse Lamp Division, Bloomfield, N. J. The fundamentals of radiant heat are presented in the first section of this publication, followed by four pages of photographs showing typical drying lamp installations. Application data, with formulas for calculating the number of kilowatts required to produce the necessary amount of heat, and recommended spacing of the lamps are included. All types and sizes of Westinghouse drying lamps are listed and described.

● HOOVER PRODUCTS, INC., YOUNGSTOWN, OHIO, has issued an illustrated descriptive folder showing Plakie products, plastic toys which include sanitary, colorfast, teething beads and disks, rattles, bath toys, feeding sets, plates and mugs, and nursery lamps.

●AN ANALYSIS OF LUBRICATION PROBLEMS AND methods of meeting them effectively under high temperature conditions in a wide variety of specific applications is contained in a new technical bulletin released by Acheson Colloids Corp., Port Huron, Michigan.

●AN ORGANIZED EFFORT TO REDUCE LOSSES SUFfered by management and labor throughout the heavy industries because of sick absenteeism is being launched by Air Hygiene Foundation of America, Inc., Pittsburgh, Pa. A preliminary report summarizing the program and discussing the extent, causes and control of sick absenteeism in industry is available to interested companies through the Foundation at 25¢ per copy.

● DESCRIBED AS OF INTEREST TO ALL INDUSTRIAL executives, and of specific value to the technically minded plant superintendent, is the new detailed catalog *Amercoat—Plastic Coatings*, just issued by the American Concrete and Steel Pipe Co., Box 3428, Terminal Annex, P. O., Los Angeles.

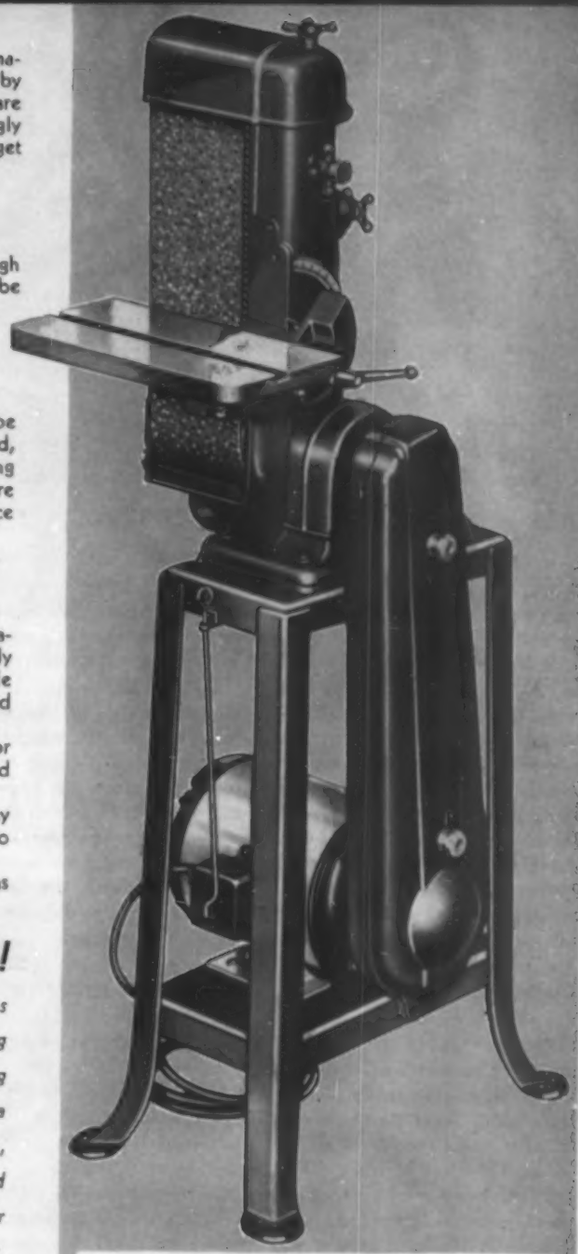
The catalog, amply illustrated and printed in two colors on coated book stock, consists of 16 large pages, which explain the diversified uses to which this product may be put in modern industry. Amercoat, defined briefly as a sprayable plastic coating which is corrosion-proof and non-contaminating, is disclosed by the manufacturer's brochure as being useful and highly profitable for an amazing range of things.

● THRUSTOR OPERATED VALVES FOR PIPE SIZES OF 1 in. to 10 in., inclusive, are described in bulletin GEA-1569B recently published by General Electric Co., Schenectady, N. Y.

● "THE LABORATORY PRODUCES A GIANT" IS THE title of a general article on plastics featured in the December 12, 1940, issue of *Domestic Commerce* a bulletin issued by the U. S. Dept. of Commerce, Washington, D. C. This article by J. N. Taylor, is a brief, clear, well-presented outline of plastics, their technical and use classifications, growth, potentials and production, and is of particular interest to businessmen and newcomers to the field.

Every Plastic Plant Can Use These Machines

These new Delta low-cost abrasive-belt and abrasive-disk finishing machines are ideal tools for every type of plastic plant—as is demonstrated by numerous installations by many leading plastic manufacturers. They are flexible, portable, compact and extremely efficient. Their first cost is surprisingly low as is their cost of maintenance and operation. Best of all—you can get quick delivery on them NOW.



DELTA ABRASIVE-BELT FINISHING MACHINE

Here is a 6" abrasive-belt finishing machine that is heavy and husky enough to do any of the dozens of sanding, polishing and finishing operations to be found around the average shop, yet which is portable enough to be used just where it is needed. It has found wide acceptance for finning, finishing and surfacing plastic parts. Every feature has been studied to eliminate disadvantages usually found in small belt polishing machines. The frame is heavy and substantial; the adjustments convenient and positive in action; attachments are quickly attached or removed; the machine may be used either vertically or horizontally, as required. It is completely guarded, and dust removal may be made efficiently. It is completely ball-bearing equipped with double-seal bearings, lubricated at the factory for life. There is no rubber covering required on the drugs which eliminates one source of replacement expense.

DELTA ABRASIVE-DISK FINISHING MACHINE

Designed to meet every requirement for accurate finishing, this new abrasive-disk machine is a high-grade tool for high grade work. From its completely machined, true-running 12" disk to its large surface table and the husky spindle of the belt-drive machine, carried on self-sealed ball bearings, it is designed for long life, low power consumption and accurate, dependable results.

Made in two models; one a direct-drive unit employing either a 1/2 H.P. or a 3/4 H.P. ball-bearing motor. The disk in this unit fits directly onto the end of the motor shaft, making the machine completely self-contained.

The other model is a belt-drive unit, which makes it possible to use any motor available, to use motors built for odd frequencies or voltages and to vary the speed to suit individual operations.

Dust collector available, making machine adaptable for use in locations where dust is objectionable.

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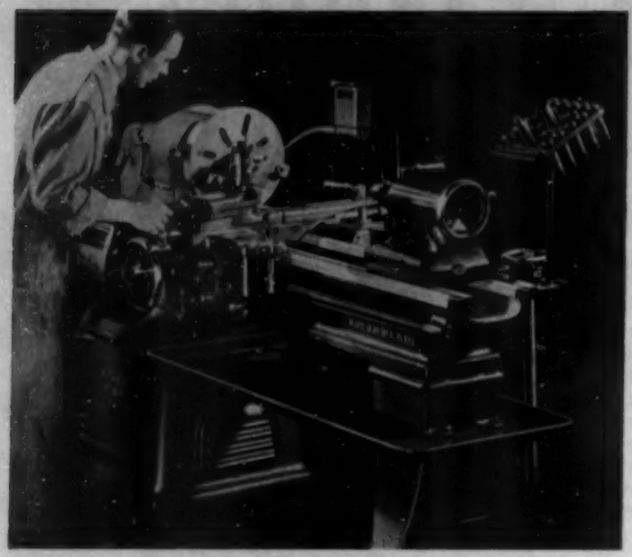


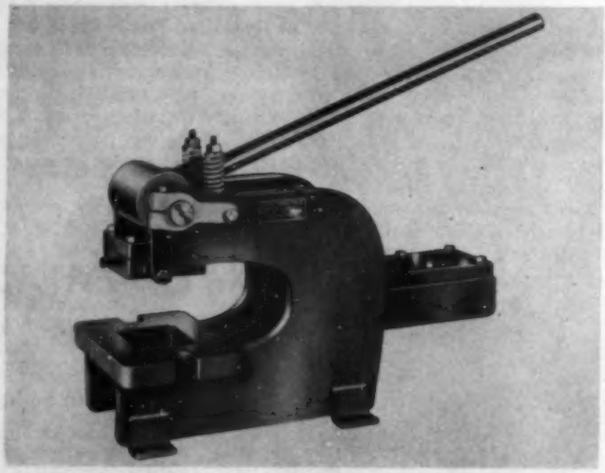
● A NEW SERIES "S" TOOL ROOM LATHE, SHOWN above, by the South Bend Lathe Works has a number of features which save time on toolroom operations, it is claimed. This 16-in. swing underneath belt motor driven precision lathe is made in 6-ft., 7-ft. and 8-ft. bed lengths, having distance between centers of 34-in., 46-in. and 58-inches. The headstock has 1⅜-in. capacity through the spindle and takes collets up to 1-in. capacity. The design of this lathe is said to make it especially adapted to fine toolroom work, reducing operator fatigue and assuring maximum production. Large diameter hand wheels facilitate precision adjustments on close tolerance work. Adjustable micrometer collars on the cross feed screw and the compound rest screw are large in diameter with clear-cut, easy to read graduations. Toolroom attachments supplied with the lathe include hand wheel type draw-in collet chuck, telescopic taper micrometer carriage stop, thread dial indicator, and pan.

● TO MEET THE DEMAND FOR HIGHER HEAT DENsity ovens for infra-red baking, the C. M. Hall Lamp Co., licensee under the Ford Motor Company patents, has announced a new line of Thermalamps. Manufactured in ½ and 1 kilowatt sizes, this equipment is available in custom-designed ovens of Underwriter approved construction. The high rate of heat transfer made possible with this equipment is said to shorten baking time and improve the adhesion, durability and weather-resistant qualities of synthetic enamel finishes. This labor- and space-saving method of applying heat safely for low-temperature operations is claimed to be of particular importance in the plastics industry for piercing and forming operations on sheet materials.

● ROME MACHINERY SALES & ENGINEERING CO. make a polishing and buffing lathe arranged with two motors driving independent wheel spindles through an infinitely adjustable speed range between 600 r.p.m. minimum and 3480 r.p.m. maximum, according to the report. The unit is available with 2 hp. or 3-hp. motors. Accessories applicable include taper screw points, dust hoods with mounting brackets, high speed auxiliary wheel spindles and abrasive belt grinding attachments and compositions applicators.

● FOR MAKING CLOSE INSPECTION OF DIES, MOLDS, all types of machinery and equipment, etc., a new flashlight bulb has been developed. Known as the Sierra flashlight bulb extension it is reported to be of copper wire encased in high grade aluminum alloyed tubing. It can be projected through narrow or tortuous passage ways, around corners and through small holes which will not permit the insertion of an ordinary flashlight or electric bulb. Being bendable it can be made into a hook to be used as a trouble lamp or fashioned into its own stand and set in position so that both hands are free to work. It is suggested by the company as a handy accessory for any maintenance man or technician's tool kit.

● GENERAL ELECTRIC CO. ANNOUNCES AN ENTIRE line of completely new polyphase induction motors, in integral horsepower sizes, to conform with new industrial trends, processes, and practices. Known as the Tri-Clad motor and representing one of the most extensive product changes in the history of the company, it features modern streamlined appearance; more complete protection—through the use of a cast-iron frame—than heretofore available except in especially enclosed machines; major advances in the insulation of current-carrying parts; and improved bearing design and lubricating arrangements. At the same time, it incorporates the cast-aluminum rotor, pressure-relief system of greasing for ball-bearing motors, and other proven features, according to the release. In addition, however, it offers many new convenience features.



● LESLIE WELDING CO. IS MANUFACTURING A HAND-operated punch press (shown above) that has no ram, ways or slides, yet has, it is claimed, the accuracy of a leader pin die set. It is said to be especially adapted to blanking or punching small stampings or punching along the edges of large sheets and for rapidly handling a variety of work not practical for power presses. A unique feature of this press is the unusual means for maintaining alignment or registration of punches and dies in a leaf arm that is rigid except at its flexing point. Because of the rigidity of the leaf arm except at its flexing point and also because of the unduly wide bearing of the operating eccentric, it is claimed that, with this press, it is unnecessary to center the load on the punch plate, reducing possible shearing of dies.

In The Limelight

●DEPARTMENT OF COMMERCE REPORTS ON CELLULOSE plastic products production for first 11 months 1940 reveal the progress that injection molding types of cellulosic materials are making.

The statistics on cellulose plastic products production released by the Department of Commerce for November 1940 reveal a significant transition which is occurring in the industry. Injection molded cellulose plastics are taking the place of many parts, such as knife handles and combs which were formerly machined or formed from heavy gages of pyroxylin sheets. Injection prices are also supplanting applications of thin gage nitrocellulose stock. This transition is specially widest in the novelty field where costume jewelry, heretofore fabricated from either sheets or rods, is now being injection molded.

While this migration from one type of material, from one method of manufacturing to another advances, nitrocellulose still continues to retain many of its old established uses. As the figures indicate, nitrocellulose accounted for 39% of the cellulose plastics which were shipped in the first 11 months of 1940.

SHIPMENTS, AND CONSUMPTION IN REPORTING COMPANY PLANTS (POUNDS)

	Nitrocellulose				Cellulose Acetate		
Year and month	Sheets, Shipments[1]	Rods, Shipments[1]	Tubes, shipments[1]	Sheets, rods, and tubes consumed in reporting company plants	Shipments[1]	Consumed in reporting company plants	Molding Composition, Shipments[1]
1940							
Jan.	749,002	275,316	56,805	271,041	751,429	9,144	1,023,808
Feb.	594,261	257,399	66,739	185,863	655,076	7,052	877,685
March	607,267	255,511	61,739	212,155	588,516	12,044	1,021,579
April	561,119	231,937	55,106	174,304	490,206	18,188	903,785
May	645,921	222,296	58,211	171,446	648,535	9,717	837,151
June	587,953	203,560	58,538	212,194	562,223	5,506	682,095
July	679,766	210,930	64,158	167,801	407,830	7,552	777,367
August	670,897	246,200	52,445	168,355	783,686	7,018	1,341,994
Sept.	745,068	282,714	85,636	279,525	754,786	8,025	1,501,463
Oct.	767,010	273,758	95,183	246,662	944,361	9,055	1,783,269
Nov.	730,384	305,657	94,958	207,355	1,036,674	4,536	1,410,496
Total (11 mos.)	7,338,648	2,765,278	749,518	2,296,701	7,623,322	97,837	12,160,692
1939							
Jan.	685,139	220,464	50,809	242,280	855,778	6,409	682,428
Feb.	698,393	230,625	48,273	256,846	1,014,295	8,586	770,006
March	818,229	290,064	62,749	342,458	1,029,302	14,360	809,718
April	663,460	238,098	48,521	286,800	522,246	11,555	599,609
May	626,647	259,152	54,017	249,100	508,786	9,861	704,085
June	703,764	240,930	55,159	296,746	378,046	9,218	702,854
July	600,701	199,282	46,844	220,846	536,674	6,132	604,476
August	741,297	244,699	79,332	326,079	814,634	6,915	967,367
Sept.	840,886	239,439	76,123	327,778	676,669	7,375	1,152,791
Oct.	894,318	262,835	84,827	310,708	683,637	14,249	1,332,699
Nov.	861,442	295,438	86,820	345,582	793,028	9,725	1,119,050
Total (11 mos.)	8,124,276	2,721,026	693,474	3,205,223	7,813,195	104,385	9,445,137

[1] Includes consumption in reporting company plants.
[2] Excludes consumption in reporting company plants.

●BAKELITE CORP., UNIT OF UNION CARBIDE AND Carbon Corp., announces the opening of a varnish resin sales office at 4228 Forest Park Blvd., St. Louis, Missouri. E. L. Metcalf has been appointed in charge and will render technical service to the south and southwest territories in connection with the company's synthetic resins for protective coatings.

●ANNOUNCEMENT HAS BEEN MADE OF THE FORMAtion of a society to be known as The American Academy for Plastic Research in Dentistry. Preliminary steps for the organization of this society were taken at a recent meeting of the Greater New York Dental meeting during which clinical demonstrations showing the practical application of plastics in the construction of dental crowns, inlays and bridges were given.

PHOTO BY ENGBY, BOSTON

● REPORTS FROM THE INSTITUTE OF MODERN ART, Boston, Mass., indicate that the current exhibition of design in American plastics has created a tremendous furor. In addition to a laboratory molding machine, many plastic items including wearing apparel, furniture, sculpture, hardware, accessories are shown, and winners in recent MODERN PLASTICS COMPETITIONS are featured. Victor Polatschek, first clarinetist of the Boston Symphony Orchestra is pictured above with a transparent plastic clarinet, an award winner in the Fourth Annual Competition. After the Boston tenure the exhibition is scheduled for the Springfield Art Museum and probably thereafter for the Cleveland Art Museum.

● DUMOR PLASTICS, INC., DUNBARTON, N. J., REPORTS it has recently organized to produce a newly developed plastic designed for either compression or injection molding, with various fillers. The product is said to be especially applicable in the electrical field. Ledyard Heckscher is president of the company and A. H. Ciaglia, plant manager.

●EXPANSION OF THE PLASTICS RESEARCH LABORAtories of E. I. du Pont de Nemours & Co. by construction of an additional building at Arlington, N. J., has been authorized, it was announced recently by Arnold E. Pitcher, General Manager of the Plastics Department.

The structure will add approximately 25 percent to the physical size of the laboratories, which will constitute one of the largest plastics research centers in the world, it is claimed. It will be two stories with basement and will provide 11,000 square feet of additional floor space. It is expected the building will be ready for use May 1, 1941. Mr. Pitcher said the new facilities would be utilized toward improvement of present plastics and the development of new types, with increasing attention to the use of plastics in national defense.

● AMERICA'S FIRST COMMERCIALLY BUILT ELECtron microscope, which enables scientists to picture minute objects at 100,000 times natural size, is now being operated in the Stamford Laboratories of the American Cyanamid Co., Stamford, Conn., according to an announcement made by the company. Although several experimental microscopes of the kind have been built and used, the first American commercial instrument is being used by American Cyanamid's scientists to develop new chemicals for industry and medicine. The instrument was developed and built by the RCA Research Laboratories in Camden, N. J.

(Please turn to next page)

● PLANS ARE BEING ARRANGED FOR A TECHNICAL conference on Plastics in Washington, D. C., to be held February 21st it is announced by the Society of the Plastics industry. The Board of Directors of the Society, at a special meeting, January 17, 1941, appointed a committee on plastics for defense. With the expanding number of applications of plastics in various pieces of Army and Navy material the need for collaborative technical and development activity is becoming increasingly important. Some of the important places where plastics are performing essential services are for windows in aircraft, in battleships, for wire insulation, for lenses in gas masks and for parts of electrical switches and for major parts in field communications instruments. Advanced experimental work is being done in structural aircraft parts. The Army Air Corps has ordered several trial trainer planes constructed of plastic plywood.

The work of the committee will be principally technical. It will also involve the exploration of new plastic applications, some of which are partially developed with still others to be developed.

●PRINTLOID, INC., 93 MERCER ST., NEW YORK CITY, announces the installation of new equipment for the fabrication of methyl methacrylate. The equipment includes facilities for cutting, drilling, forming and polishing.

● REED PRENTICE CORP., WORCESTER, MASS., REports it has contracted for plant expansion of building and machinery in the total of $400,000 in order to double the capacity of their production of engine and toolroom lathes for the National Defense Program. F. W. McIntyre, vice president and general manager of the company has joined Howard W. Dunbar, vice president of the Norton Co. on work for the Council of National Defense, Machine Tool Coordinating Committee.

● AIRCRAFT RESEARCH CORP. IS NOW LOCATED AT Beachwood Avenue and Second Street, New Rochelle, N. Y. Telephone Hamilton 4-4441, it is announced.

● IMPORTANT NEW ADDITIONS TO PLANT AND equipment are reported to have been completed in 1940 by the Calco Chemical Div., American Cyanamid Co., Bound Brook, N. J. Among the new units placed in operation by this organization, are a 60 million-gallon effluent plant, the first unit of a new pharmaceutical building, a new power plant addition, and a 970-foot warehouse. During 1940 also, a modern, air-conditioned employees' cafeteria, and an addition to the group of tar acid stills were made.

Perhaps the most interesting of these is the new 60 million-gallon effluent plant, shown above. After several years of intensive research and experimentation with a $40,000 pilot plant, a plant was designed to thoroughly treat Calco's acid, odorous and colored effluent. Because of Calco's peculiar waste problem, this plant makes use of features never before employed for this purpose.

● COMPLETE AIRING OF NEEDS IN ALL BRANCHES of the defense program will highlight the forthcoming Machine Tool and Progress Exhibition March 25–29 at Detroit's Convention Hall. Held in conjunction with the annual convention of the American Society of Tool Engineers, sponsors of the exhibition, sessions each day will include talks by army, navy and aircraft officials and executives and engineers of industry.

● WITH THE OPENING OF A CLEVELAND, OHIO, office, the editors and publishers of MODERN PLASTICS Magazine, are pleased to announce that we have expanded our services and now have representatives in New York, Chicago, Los Angeles and Cleveland. Robert L. Davidson is in charge of the Cleveland branch with headquarters at 1010 Euclid Ave.; telephone, Prospect 2020. These offices also serve *Modern Plastics Catalog*, *Modern Packaging* Magazine, and *Packaging Catalog*.

● GEMLOID CORP., L. I., N. Y., CUSTOM MOLDERS and manufacturers of Gemlite and Gemloid decorative plastics, announce a sales and design representation in the Michigan territory with offices in the Boulevard Building, Detroit, with Franklin W. Murray in charge, collaborating with Lawrence H. Wilson, Industrial Designer, as a stylist.

● AT THE 36TH ANNUAL NATIONAL MOTOR BOAT show held at Grand Central Palace, New York, from January 10 to 18, United States Plywood Corp. exhibited boats molded from plastic plywood. They included in their display scale models which demonstrated the several steps of manufacture. Unfinished hulls as they come from the molds were shown, and the limited number of subsequent operations involved in making a finished boat from plastic-plywood hulls were demonstrated. Several of the standard sizes of hulls and boats which are in regular production were displayed.

●THE PLASTICS DEPARTMENT OF THE GENERAL Electric Co., operating at full manufacturing capacity, recorded the largest sales volume in its history during 1940, it is announced by G. H. Shill, manager of the department located at Pittsfield, Mass. An outstanding achievement during the year was the large scale production of plastic shoe heels for women's shoes, which notably illustrated the important tie-in between development, manufacture and sales in the department.

● BROKAW MACHINERY CO., CINCINNATI, OHIO, REports it will handle an extensive line of plastic molding machinery and supplies for industries in the Indiana and Ohio territory. In addition to both compression and injection molding equipment handled in the past the company informs us they will have extrusion transfer, preforming printing, marking and catingo machinery. Also, a display of molded products will be on display at the store located at 426 W. Fourth Street.

● MASTER PLASTIC CORP., 1609 NORTH BROADWAY, St. Louis, Mo., reports it is entering the injection molding field.

● PRICE REDUCTIONS ON FIVE ROSIN ESTERS HAVE been announced by Hercules Powder Co., effective January 1. New base prices in carload f.o.b. Hercules, Delaware, are as follows: Abalyn, methyl abietate, reduced from 10 cents to 7 cents a pound; Hercolyn, hydrogenated methyl abietate, from 15 cents to 11 cents a pound; Flexalyn, diethylene glycol diabietate (80% solution in xylene), from 14¾ cents to 12 cents a pound; Pentalyn, a pentaerythritol-abietate resin, from 12 cents to 10½ cents a pound; and Pentalyn G, higher melting pentaerythritol abietate, from 13½ to 12 cents a pound.

A wide range of properties is said to make these rosin esters suitable for many industries, as solvents, plasticizers and special-purpose ingredients in a variety of compositions.

● A PROGRAM THAT WILL CONSIDER ALL OF THE principal developments and the likely trends in the field of packaging, packing and shipping is being planned for the Conference that will run concurrently with the 11th Annual Packaging Exposition at the Stevens Hotel in Chicago, on April 1–4. Both the Conference and the Exposition will be sponsored by the American Management Association. Special attention will be given to the effect of the National defense program on packaging.

(Please turn to page 98)

London Mail Box

Mailed on Dec. 14th and Jan. 15th by Mrs. John S. Trevor, wife of our London correspondent, these late communications summarize the part the British plastics industry has taken in the conduct of the present war and new developments. (Editor)

THIS is the time of the year when one takes stock and it is, therefore, natural to consider briefly the way in which the British plastics industry has weathered the storm of war during the last 12 months, and, what is more important, its ability to progress during 1941.

At the beginning of 1940 the importance of the industry both economically and strategically was not fully appreciated by the British War Departments and it was not until the Spring of 1940 that the Air Ministry adopted a definite policy of practical encouragement. Every month that has passed since then has witnessed an acceleration of interest by the Authorities in the general replacement of metal, particularly the light alloys, by plastics and the development of new designs for component parts which can exploit the peculiar properties of plastics.

The next page in the 1940 diary of the British plastics industry deals with the effect on it of the collapse of France. This meant the immediate cessation of supplies of a large proportion of acetate sheet ready for fabrication. Fortunately a well-known British chemical manufacturer was able to promise a home-made material to fill the gap.

The Autumn witnessed a general speed-up in plastics material production and the development of a comprehensive plan to build up a reserve of manufacturing plant which could be mobilized immediately in the event of the main plant being damaged by aerial attack. Towards the end of the year came the realization that home production would have to be speeded-up still more so as to make good substantial losses through enemy submarine activity. Thus the year 1941 opens up with the full knowledge that the industry has to play a vital part in perfecting an all powerful war machine. Coupled with this is an appreciation by the leaders of the industry that the machinery and organization of production must never be allowed to be mortally wounded by enemy night bombings.

As regards the molding side of the British plastics industry 1940 witnessed an unofficial stock taking of available plant and the completion of successful attempts to manufacture in the United Kingdom Continental types of presses. Tools became increasingly difficult to secure as the year progressed owing to the general restrictions placed on the use of high grade steels and the great difficulty of securing skilled labor. These two factors lead to the extensive use of stock molds and the simplification of all new designs when stock molds were not available. Looking immediately ahead it is obvious that the labor problem may soon become acute as more skilled men are migrating into the highly remunerative armament industries and the younger unskilled and semi-skilled men are joining the fighting services. Obviously more female labor will have to be employed and this is indicated by the fact that arrangements have already been made for the progressive training of suitable women in Government Training Centers for engineering jobs.

There is no shadow of doubt that the British plastics industry faces 1941 with complete confidence and the realization that it is playing a vital part in hastening the approach of Victory. When Peace does come to the troubled world the British plastics industry, by reason of its initiative and resource in wartime will, we are confident, be able to develop many new markets now barely kept alive by rationed orders. The British trade press should receive great credit for its courage and leadership during these most difficult times. *(Dated Dec. 14, 1940)*

New uses for plastics in British ARP services

Some months ago there was a good deal of talk about producing molded plastic helmets for use in the army and civil defence organizations in place of the heavy steel headgear. After various trials carried out by the War Office and Ministry of Supply the plastic helmet molded of shock-resisting, cotton-filled, phenol-formaldehyde resin was turned down and there the matter rested. It has now been resurrected due to the urgent requirements of the civilian population for a light weight and yet really efficient helmet. Molded helmets are now on sale in some of the largest London stores and sell at 15 shillings each.

With reference to the needs of the civil defence organizations it is of interest to note that there is now a growing demand for shock resisting shoulder pads which would prevent or minimize fractures caused when debris falls on firemen and wardens, etc. The suggestion has been put forward that pieces of laminated sheet, $^1/_{16}$ in. thick, suitably curved to fit the shoulder and lined with shock-resisting aerated rubber, would afford a high degree of protection and also have the great advantage of being very light and non-corrodible even when soaked in water during fire fighting.

Another very interesting and topical application of plastics in connection with ARP has just been revealed. This is a simply designed mask fabricated of cellulose acetate which consists of a screen $5^1/_2$ in. square supported by an elastic band. It is in effect very similar to the type of mask worn by surgeons during long operations to prevent infection through condensation droplets. This new mask, which it is hoped will soon be available in very large quantities, is designed to prevent the spread of infection in air raid shelters.

Compulsory powers have now been conferred upon local authorities and Medical Officers of Health to see that all possible precautions are taken to prevent the tube and surface shelters from becoming dangerous breeding places for infectious diseases. It is the opinion of experts that the use of these face masks will help very materially in preventing the spread of influenza, tuberculosis, as well as highly infectious fevers, in conditions very favorable to infection. The alternative to the acetate mask is one of the gauze type consisting of at least 4 layers of muslin of at least 44 threads to the inch. This mask is far more uncomfortable to wear than the plastic type.

Another potential outlet for plastics in ARP is the use of a molded spray attachment which could be fitted to the standard stirrup pump used for extinguishing incendiary bombs. This attachment would enable the pump to be used for spraying an efficient mist spray of disinfectant solution for cleansing the atmosphere of the shelter and also preventing the dust from rising. At present these fine spray attachments are all fabricated of metal and are not only very expensive to produce but they are subject to corrosion when phenolic and hypochlorite disinfectants are used. The most suitable type of plastic for this purpose would be an asbestos filled phenolic resin. Your correspondent understands that the idea is being discussed by certain firms.

The aerial blitz continues almost nightly and about 6 p.m. the barrage opens up in London. It has become almost monotonous and with monotony fear has almost disappeared. To use a now prevalent slang term, the British are becoming properly "browned off" with air raids; to be "browned off" is to be bored to extinction. This is probably an exaggeration, but there is no doubt that even when threatened with the most violent of deaths the average man in the street displays an amazing nonchalance.

Special precautions are being taken by all firms in the plastics industry, particularly as regards the storage of inflammable and partly inflammable materials, celluloid sheet, toilet goods fabricated from celluloid, and raw acetate material. Generous use is being made of all underground store rooms and many firms are constructing small asbestos cement huts in their grounds where such goods can be safely stored without menacing the safety of the main plant. Under recent legislation every factory and commercial building must now provide fire watchers who have to keep a constant lookout throughout the 24 hours for incendiary bombs. Immediate action with the stirrup pump prevents small fires from developing into serious ones. *(Jan. 15, 1941)*

Twentieth century ice boxes

(*Continued from page 31*) period of several years. In some refrigerators at least, parts are subject to contact with alcohol, which does not affect polystyrene. Since refrigerators are used for the storage of foodstuffs, they are subject to frequent cleaning by the housewife. Occasionally high concentrations of free alkali are found in soaps and cleansers used for such purposes, and it is necessary that polystyrene be unaffected even by prolonged contact with such alkalies.

Refrigerator manufacturers in supplying materials to be used in the interiors of refrigerator cabinets lay down strict requirements that such materials be perfectly odorless and impart no taste to the foods stored. Fully polymerized styrene of which polystyrene molding material consists, is odorless and tasteless. There is, therefore, no danger of molded parts imparting taste to the food or odor to the box. Furthermore, styrene contains no plasticizer which in some cases causes an odor of its own. A property of polystyrene that has been given close attention in the design of the new refrigerators is its heat insulating faculty—a factor suggesting even wider use of polystyrene by the refrigerator industry in the future.

Table 1 compares the thermal conductivities of six plastics and four materials usually classed as specialty insulating materials. It is interesting to note that according to this data, polystyrene is twice as efficient as the material which most closely approximates it (cast phenolic) and compares well with the specialty insulating materials such as felt, cork board and expanded rubber, all of which depend on trapped, dead air spaces for part of their insulating efficiency. It may be mentioned that if a method could be developed to aerate polystyrene, a material of outstanding heat insulating properties would be evolved. At this time the low thermal conductivity is particularly important in the new sealing frames and evaporator doors.

Polystyrene has been developed primarily as an injection molding material. In comparison with compression molding, this method as applied to thermoplastics, usually allows considerably higher speed of production. In addition, injection molding allows greater freedom in designing the part, since intricate cavities and deep draws can be molded more readily.

Table 1

HEAT INSULATING PROPERTIES OF POLYSTYRENE COMPARED WITH OTHER PLASTICS AND WITH STANDARD INSULATING MATERIALS

(Thermal conductivities—centimeter—gram—second scale.)

Polystyrene	0.0002[1]
Phenol formaldehyde moldings	0.0005[1]
Urea-formaldehyde moldings	0.0007[1]
Laminated phenolics	0.0005[1]
Cast phenolics	0.0004[1]
Cellulose plastics	0.0005[1]
Expanded rubber	0.00008[2]
Corkboard	0.000098[2]
Hair felt	0.000105[2]
Wool felt	0.000140[2]

[1] *Plastics*, Vol. IV, No. 42, November 1940, p. 239.
[2] Harold Tongue, "Chemical Engineering," Chapman & Hall Ltd.

7—This drip tray baffle plate for dispensing interior humidity is of polystyrene since the material is unaffected by constantly retaining water at reduced temperatures

Since one of the basic reasons for the use of a plastic material for molding interior refrigerator parts is to give improved styling to the unit, it is highly advantageous to use a material that has wide color possibilities. Polystyrene is inherently a clear, sparkling transparent and hence can be formulated in opaque, translucent and transparent colors. This fact is particularly important where a particular color is specified.

The crystal transparency of polystyrene is used to fullest advantage in evaporator doors. An interesting effect here is obtained when the inside of the door becomes covered with frost, well befitting the function of the unit. For most interior parts a gleaming white is desirable and this is readily produced in polystyrene. The large injection molded insulating frame described later is molded of polystyrene in a color that matches perfectly the porcelain sections of the interior.

Notable among applications of polystyrene in 1941 refrigerators are the large molded parts used on the new Philco models. Four of these models are designed with the freezing unit arranged horizontally across the top of the storage space. This unit consists of two parts, the left-hand side being an oversize freezing section, while on the right a compartment for the storage of frozen foods is provided. The insulating frame that seals in this unit and goes around both doors is molded in one piece of lustrous white polystyrene. This part, one of the largest pieces ever injection molded, covers 204 sq. in. and weighs 19¼ ounces. (Fig. 4.)

Other Philco refrigerators are designed with a freezing unit that more nearly resembles conventional design;

but the evaporator door on these models is far from conventional. It is molded of crystal clear polystyrene, and decorated with horizontal metal bands, knob and hinge. An unusual appearance is given to the door when the unit is in use, since the inside surface frosts quickly, giving an effect of wintry cold. (Fig. 5.)

Utilizing the inherent beauty of polystyrene to the fullest extent, the design motif followed in the new Westinghouse line is a distinct departure from previous ideas of refrigerator styling. Important historical figures, Martha Washington, Dolly Madison and Betsy Ross, have been chosen for the theme in the line, and followed through in advertising promotion and sales. The evaporator, or freezing unit, door is the center of attraction when the door is opened. On one of the models in the line, for example, is a vertical section of blue polystyrene molded with a plaque in the profile of Betsy Ross, flanked by two sections of horizontally fluted metal stamping, creating a novel yet appropriate effect. (Fig. 1.)

Another manufacturer has adopted a flat, shallow drip tray molded of polystyrene. This part, which competes with those previously mentioned for the claim of largest injection molding, is designed with a ribbed back which adds strength, but does not impair the transparency of the part. (Fig. 7.)

Molding these large pieces called for consumate skill in engineering. The dies had to be machined extremely carefully because any variance would allow flashing of the material between the die halves. In the case of the insulating frame, four separate injection chambers, each capable of shooting eight ounces, were used. In moldings of this size, it is necessary to get the material into the die cavity as quickly as possible since a slow injection tends to chill and harden the material before the die is completely filled, so that partly molded pieces are the result.

The control of clamp pressures is also of vital importance in molding operations of this type. As the projected area of the mold increases, the material being injected exerts an increasingly powerful hydraulic effect, tending to open the die halves. As a result, pressures of over 1,000,000 lbs. must be applied by the clamping ram to keep the die halves closed while the material is injected.

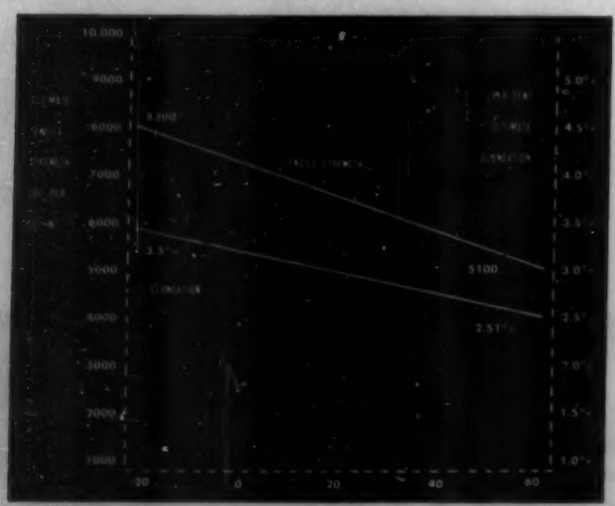
To accomplish this, injection machines of tremendous sizes are used. The clamp ram is arranged vertically, and with the hydraulic cylinder, is three or four times taller than a man. The die is arranged at the base of this ram and opens and closes vertically. Four heating and injecting chambers with hoppers above each are arranged two to a side. As the die closes, the nozzles on these units move forward to make a seal with the gates in the die. Then a ram in each injection unit drives forward, shooting the material into the cavity. The die is chilled and as soon as the piece is hardened, the nozzles move back, the die opens and the completed piece is ejected.

General Electric uses four parts of polystyrene in the new models. Two of these are used in the control dial designed for high visibility and convenience in operating. A round molding serves as the dial itself, with numbers printed around the outside surface. The lower section of this same piece has a serrated edge. When assembled on the freezing unit this molding is partly concealed by another of this same material. This second molding has a narrow slot in it through which a part of the serrated dial extends, allowing the dial to be turned. A window, left transparent in the otherwise blue cover, permits reading the dial numbers.

Another innovation on the new General Electric refrigerators is a separate enclosed compartment for storing butter at precisely the correct temperature. This compartment which is the right size to hold a pound of butter, is designed with a front frame molded of pure white styrene, helping make the unit readily cleanable and smart. (Fig. 9.) (*Please turn to next page*)

9—New General Electric refrigerators are designed with 4 polystyrene parts. The round serrated piece fits together with the flat molding to form the indicator dial. The white frame and small rod are used in a separate butter storage compartment

The results in Fig. 8 (below) showing increasing strength of polystyrene as the temperature drops, are substantiated by results of impact tests



The application of polystyrene to refrigerators has made tremendous strides forward in the design of the 1941 lines of the leading manufacturers. This does not mean, however, that progress in the future will not be as great. We are dealing with a material which is relatively new and with an industry which continues to expand rapidly. By the combined efforts of refrigerator designers, molders and material suppliers we can be assured that even more striking innovations will be forthcoming in the future. While moldings of a size to form a complete inner cabinet are still well in the future, it is a fascinating thought that some day this might come to fruition.

Credits: Material: Monsanto Lustron; Molders: Thermo-Plastics Div., The Standard Products Co. and Plastics Dept., General Electric Company.

U. S. Navy plastics program

Continued from page (33) So the details are shown merely to illustrate the basic ideas, to give them point. The *direction*, the *trend*, is the important consideration; and it is to be emphasized that this features as its cardinal virtues:

(*a*) A 'questioning' frame of mind.
(*b*) The maintenance of 'confidence' in the Navy's fairness.
(*c*) An 'experimental' approach.
(*d*) A massed or 'cooperative' attack.

Step No. 1

"The first step is essentially an *estimate of the situation*, a survey of the service needs and of the existing possible means of meeting them. Actually, this has been in progress for something over 10 years, during which time many hundreds of tests have been made and considerable data are available for analysis. In order, however, to establish some 'bench-marks' from which to make the start, it is necessary to prepare a number of proposed Navy Department Specifications. The 'questions' which have been uncovered in this estimate of the situation are largely responsible for this series of articles and for the program in mind. This estimate is constantly under revision."

Step No. 2

"This step consists in making available to industry, through the medium of Navy Department purchase specifications, the technical data gleaned from Step No. 1. About a dozen new specifications are involved, covering several of the newer types and classes of electrical insulations. Some of these specifications are now in the course of preparation; the others to follow as soon as practicable. It is to be emphasized that these specifications will not attempt to state what an insulating material is to be made of, nor how it is to be constructed; but rather what its performance must be, i.e., the specifications will define *functions* rather than constructions. These specifications, serving as bases and definitions, will be utilized in Step No. 4 for the further development of electrical insulating materials and combinations of material; and again, in Step No. 5 for the purchase of new, lightweight designs of electrical machinery."

Step No. 3

"Expedite the completion of the several projects covered by experimental directives having to do with the development of better testing methods. This phase already has been in progress for about 2 years, and much of it is nearing completion. Accelerate the tempo. Add new objectives as fast as these can be foreseen. The new test methods, the new 'yardsticks' upon which the most emphasis is being placed at present (and for the immediate future) are longevity, heat resistance, stability, permanence, flame-resistance, arc resistance, oil-resistance, acid and alkali resistance, sea water resistance, abrasion resistance, deep drying, moisture resistance, thermal conductivity, impact resistance, plastic deformation (yield or 'creep'), dielectric strength, insulation resistance, power factor, dielectric losses, etc. While some of these methods have been utilized before, they were primarily adapted to the use of the older materials; and the development of the newer materials and newer techniques (glass fiber, films, synthetics, etc.) requires a different approach. The newer test methods are to be streamlined along functional lines so as to provide for what is to be rather than for what has been."

Step No. 4

"This is where industry 'cooperation' must begin to take hold in a thorough manner. Prepare inquiries for submission to several manufacturers of electrical insulation, asking them if they desire to quote on certain new developments in electrical insulation. Purchase and test these under the usual development procedure. Several possible new combinations and improvements now suggest themselves. Others will no doubt come about as the experimental tests proceed."

Ed. Note: *As mentioned in this article certain Navy specifications have been established while others are being prepared. The Navy because it has the facilities for conducting tests and also because of the numerous applications which have been made of various plastic materials in all types of ships and in airplanes has probably done as much experimental work on plastics for war purposes as any other government branch. Specifications covering plastics which have been established by other governmental departments are herewith listed. An additional naval specification is included.*

Plastics, Transparent, Flame-Resisting Sheet
Navy Aeronautical Specification P-41b
Sheet; Transparent
U. S. Army Specification No. 94-12014-B
Air Corps
Plastic, Sheet, Cellulose Acetate Base
U. S. Army Air Corps Specification No. 12025-B
Hats, Protective
Treasury Department Procurement Division Specification No. 367A
Lens, Cylindrical, Molded
Chemical Warfare Specification No. 197-51-132

Synthetic wire coverings

(*Continued from page 35*) who did the work of installation. Fig. 2 shows the insulated lead wires[2] being soldered on a section of this control board. Fig. 3 shows the completed control board and Fig. 4 a close-up of a part of the 600,000 odd feet of insulated wire used on this single installation. Synthetic insulation is preferred for this type of work because the thin, braid-less walls (about .015 in.) strip freely from the conductor, thus facilitating soldering. The wide range of available colors aid quick and permanent identification.

Certain physical properties that are characteristic of vinyl insulating compounds give an important advantage to these applications. For example, any electrically energized wire is a potential fire hazard and most specifications pertaining to inside wiring stipulates that the insulated wire must be non-burning or at the worst, slow burning. Since the vinyl wire insulation is inherently flame-resistant it is not necessary (as in the case of rubber insulation) to add any further covering or treatment to provide such protection. Other features such as good heat aging, water, oil, and sunlight resistance are afforded by the vinyl insulations.

Table I shows typical electrical properties measured upon vinyl insulated wire specimens. It should be noted that the electrical constants of the extruded wire insulation are seldom as good as the values of the base resin. This is due to the large amounts of plasticizers necessary for flexibility. These plasticizers usually have poorer electrical constants than the resin so that their introduction has an adverse effect on the electrical properties of the final compound. This condition is similar for any plasticized thermoplastic.

Another less common, but nevertheless useful synthetic wire insulation is ethylcellulose. This material may be extruded, used in lacquer coatings for braids, or applied as a tape. The flame and moisture resistance of ethyl cellulose coverings is not as satisfactory as obtained with the vinyl coverings.

Polystyrene possesses outstanding electrical constants and has promise of making a very useful wire insulation. Processing difficulties and certain physical properties have limited its use as a wire covering except in the form of tapes or when combined with rubber or other materials. When combined in such a manner its most favorable properties are somewhat masked.

Practically all of the insulating coverings are derived from thermoplastic resins although some rubber derivative, thermosetting materials, chloroprene polymers and organic polysulphides, have found application to a limited degree as insulations. Electrically, they are relatively poor and their wider use in cables is that of protective jacket coverings.

Jackets

Rubber insulation is usually surrounded by further coverings for greater mechanical and sunlight protection. This additional covering may also be used for appearance only or for resistance to moisture, oil, flame, etc. This covering may take the form of tapes, fabric braids, lead sheath, or another layer of a special high strength rubber compound called a *jacket*. A jacket illustration familiar to all is the rubber covered cord used on vacuum cleaners and other household appliances. A second illustration is the all-rubber lamp cord. These wires are smooth and shiny, do not pick up lint, are easily cleaned and less prone to kink than the older braided types. The use of rubber jackets in power cables is a similar but less familiar illustration. Here the two worse enemies of rubber, sunlight and oil, play a more dominant role, and to cope with them synthetics were quickly put to work.

(*Please turn to next page*)

[2] These are called *Genoseal*, the trade name of the General Cable Corp. for vinyl plastic insulations.

TABLE I. Part (1)—TYPICAL ELECTRIC PROPERTIES OF VINYL WIRE COVERING

	Vinyl	30 Percent Rubber
Dielectric Strength	1100 volts per mil	470 volts per mil
Insulation Resistance	2000 megohms per 1000 ft.	10,000 megohms per 1000 ft.
Max. recommended copper temperature:		
(1) SN Building Wire	60 deg. C.	60 deg. C.
(2) Switchboard Wire	80 deg. C.	Not generally recommended
Moisture Resistance:		
(1) Percent Increase in Capacity (10 wks.)	5%	15%
(2) Electrical stability on accelerated and long-time immersion tests	Excellent	Fair
Corona (ozone) Resistance	Excellent	Poor

	Vinyl			
	15 deg. C.	35 deg. C	50 deg. C.	70 deg. C.
Dielectric Constant	4.5	6.2	7.8	8.8
Power Factor	.09	.12	.10	.05

NOTE: Above values measured on wire sample No. 14 Awg. Sol., 1/32 in. covering.

Part (2)—TYPICAL ELECTRIC PROPERTIES OF OTHER SYNTHETIC WIRE COVERINGS

	Polystyrene	Ethylcellulose	Polyisobutylene	Polysulphide Insulation	Chloroprene Insulation
Dielectric Strength (Volts/Mil)	1100	900	700	250	250
Dielectric Constant	2.4	5.0	3.0	7.5	7.5
Power Factor	.002	.02	.01	.10	.10
Electrical Stability after long-time exposure to moisture	Excellent	Poor	Good	Good	Fair

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The properties of typical jacket compounds of rubber, organic polysulphides[3] and chloroprene polymers[4] could be tabulated as follows:

	60% Rubber Carbon Black	Polysulphide Jacket	Chloroprene Jacket
Physical Properties—			
Ten.	High	Medium	Medium
Elong.	High	High	High
Abrasion	Good	Good	Good
Tear	Good	Good	Good
Sunlight	Relatively poor	Excellent	Excellent
Ozone	Poor	Excellent	Excellent
Flame	Poor	Poor	Good
Mineral Acids	Excellent	Excellent	Excellent
Organic (Acetic) Acid	Poor	Fair	Fair
Alkali	Good	Good	Good
Oils and Greases	Poor	Excellent	Good
Organic Solvents	Very Poor	Good	Good
Moisture	Fair	Excellent	Fair

Rubber excels in mechanical properties so long as severe sunlight, ozone, and oil conditions are not encountered in service.

Portable rubber jacketed power cables give outstanding service in mining equipment. These cables are constantly abraded; subjected at times to the cutting action of falling rocks and (while this is not recommended) it may even fall beneath the wheels of an ore car. This is the type of service where rubber performs well. An example of service where synthetics are more desirable than rubber jackets is in the same type of portable power cables used around oil and chemical plants or in factories where there is abnormal exposure to oil, grease, heat, etc. Because of their excellent sunlight and ozone protection, synthetic jackets are preferred on non-leaded rubber insulated cables which are usually installed on poles between overhead and underground circuits.

Cables installed in ducts for low voltage power distribution are another example where synthetic jackets are proving their worth, such as *Network* cable which must withstand long immersion in acid and alkaline soil waters, seepage from cinder fills and occasional sewage which may back up and fill the duct. Originally a great many network systems used braided or lead covered cable, but these, while good, were not entirely trouble-free. Synthetic jackets have eliminated the objections to these coverings by affording the underlying rubber excellent protection throughout the service life of the cable. Chloroprene polymer and organic polysulphide jackets are mixed and handled on conventional rubber machinery. They may be either extruded or applied in longitudinal strips and the vulcanizing rate can be adjusted to agree with that of the underlying rubber insulation.

Thermoplastic resins such as the vinyl resins are also being used for jackets, but this is usually restricted to applications where maximum flame resistance is required and other factors are relatively secondary. These jackets may also be extruded or applied spirally around the cable as a tape. The newer butadiene copolymer[5] and olefin-diolefin copolymer[6] type synthetic rubbers are still in the experimental stage in so far as this country is concerned. The place that they may find as insulation and jackets will depend largely on the properties they show in the laboratory and field when tested against rubber and other synthetic rubber-like materials.

Table II shows typical cable products and applications where synthetic coverings are now used. Undoubtedly, this list will continue to expand as improvements are discovered for the compounding and processing of present plastic materials. Even more progress may be associated with the development of entirely new synthetic resins.

TABLE II. TYPICAL APPLICATIONS—SYNTHETIC WIRE COVERINGS

1.	Vinyl Insulation	Building wires Switchboard wires Shipboard cables Signal and Control wires Instrument wires Fixture wires Distributing frame wires Aircraft wires
2.	Polystyrene Insulation	Cables for radio, television and telephone work
3.	Ethylcellulose Insulation	Blasting wire Magnet wires
4.	Organic polysulphide polymer Insulation	Series Street Lighting cable Fixture wires
5.	Organic polysulphide polymer Jacket	Buried cables Portable Power Cords
6.	Chloroprene polymer Insulation	Control wires Small motor leads Fixture wires
7.	Chloroprene polymer Jacket	Network cable Cords Ignition cable Pole lateral cable Shipboard cables

[3] Neoprene, by E. I. du Pont de Nemours, Inc.
[4] Thiokol, by Thiokol Corp.
[5] Buna, B. F. Goodrich Co.
[6] Butyl, Standard Oil Co.

Self-service on the avenue

(*Continued from page 38*) At any rate, it is said that the company manufacturing glass looks with favor upon the whole idea! Thick, transparent plastic rods are also used for the door handles at the entrance.

Stepping inside, we find an atmosphere of good cheer and comfort. Although well illuminated, the warm colors—pinks, corals and yellows—used on the walls, floors and for decorative effects serve to temper any harshness that might otherwise result from the abundance of light. A fluorescent trough stretching around the ceiling is shielded by sheets of translucent acrylic plastic thereby producing a light that is strong, even and without glare. This material absorbs less than 5 percent of the light from the fluorescent lamps and is easily bent to conform with the corners of the room. Readily installed upon metal or wood, the sheets are

joined together with clear plastic rods thus achieving a continuous band of light. The use of this plastic in connection with the fluorescent lighting installations not only adds a note of smartness to the interior decor but a touch of practicality as well, since the material is durable and easily cleaned.

The doors leading into the kitchen are well protected from the constant punishment they are subjected to every day. Large sheets of transparent plastic cover the wood, affording protection but permitting the beautiful grain of the wood to show through. Kick plates throughout the establishment are made of this plastic as are the supports for the various signs in the windows and on the counters. In the latter instance, rods are used, grooved to hold the sign in an upright position. The stair rail and mezzanine rail also employ transparent rod stock in a practical and decorative manner. Long-wearing, cigaret-proof attractive table tops are of laminated material.

Credits: Plexiglas, Lucite and Formica; F. R. Stuckert, architect; fabricators: Milco Bronze Co., Cyrille Steiner Studios.

Molded modulation recordings

(***Continued from page 37***) separated from the original, or master, record. This negative, or thermosetting record, is used as a stamper to mold the final records of thermoplastic materials such as cellulose acetate, ethylcellulose or vinyl. Sheets or biscuits of the latter material are placed in contact with the negative and under proper heat and pressure the final record is made. If large quantities of the same record are required, additional presses can be placed in operation, since any number of stampers can be made from the original recording. This allows the production of many finished records in the shortest possible time.

Besides all of these obvious advantages as far as the manufacturing is concerned, there are other equally as important claims to be made for the finished plastic records. In the first place, the records are very thin, measuring on an average of .010 in. thick though they may be as thick as ordinary records or as thin as .005 inch. In all cases, the same type of master plastic plate is used. The final records are flexible, of course, extremely light in weight and unbreakable. The wearing qualities of the plastic record are claimed to be good, if not better, than those of the present-day phonograph record. Although these molded plastic records are lightweight and flexible, they lie flat and will not curl or warp, provided ordinary care is taken of them.

Reasons underlying the present upswing in the curve of record purchases remain a moot question, but the most astute guesses are that the radio has acted as a popularizer of good music in this country, and that the phonograph offers the public the music it wants whenever desired. Seventy-five million records, it is estimated, were sold in 1940 and it is expected that a much greater volume will be reached in 1941. What effect the current ASCAP-BMI disagreement may have is a subject of controversy but some experts feel it will further augment record sales in the interim.

With the trend toward the accumulation of home record libraries, the widespread distribution of records to the blind, the use of records for educational purposes, and the preservation of governmental and legal data through recordings, the advent of these plastic records promises much in the way of revolutionary changes. These records can be filed like manuscripts or correspondence; since they are so thin, little space is required. Easy to ship—with a piece of cardboard and a heavy envelope, the record can be sent through the mails with no worry about breakage upon arrival.

It is expected that the advantages of the manufacturing process in combination with the superior characteristics of a thin, colorful, unbreakable record will have a great appeal to the record-buying public.

Credits: Bakelite phenolic, Monsanto vinyl, and Vinylite. Process by The Gray Mfg. Company.

Patching defective lumber

(***Continued from page 39***) 73 days subjected the plastic to the attack of wood rotting fungi. The decay was measured by relative weight losses. For comparison, wood filled with the plastic, both wet-dry treated and untreated, and cubes of solid Douglas fir and solid plastic were tested in the same manner. This was the test procedure: *1.* The wood and plastic were dried to a weight of equilibrium in a vacuum desiccator; *2.* Weights were recorded; *3.* The wood and plastic were placed in jars of previously prepared thriving fungal cultures; *4.* The fungi were allowed to work on the wood and plastic for 73 days; *5.* The wood and plastic were again dried to a weight of equilibrium; *6.* Weights were recorded; *7.* The previous weights, as of (*2*), were compared with those of (*6*). In comparing results of treated with untreated plugged wood, it was evident that the wet-dry treatment had no effect upon losses by decay. The Douglas fir was thoroughly rotted with great loss of weight, while the plastic showed very little weight loss, thus indicating great rot resistance. The adherence of the plastic material to the wood was good throughout the test; only when the wood became very rotten and shrunken did the plastic show cracks around the edges.

The commercial activity of this process is, at present, confined to use in the plant which developed the plastic. It is said that keen interest has been shown in the process by lumber manufacturers from places as distant as Sweden and Australia. The company reports that, upon request from a plywood manufacturer, it did an experimental job in patching some open-faced defects in plywood that were as large as 3 inches. This application of the plastic plugging was successful, indicating that the process also has a promising future in the plywood field.

Credits: Arnold E. Lubach, Stimson Lumber Co.

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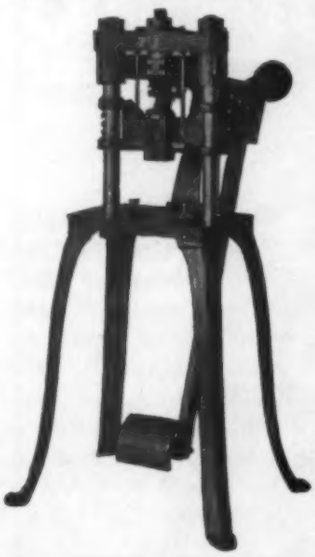

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Plastics in strange places

(*Continued from page 51*) excellent waterproofness to match heads, so that they do not deteriorate in an damp atmosphere and will even withstand immersion in water—a boon to swimmers.

Canned heat

Nitrocellulose can depart from its work as a high explosive to make its extreme flammability function with its colloidal nature in a "solid alcohol" fuel. As disclosed in U. S. Patent 2,207,894 of July 16, 1940 (Philip B. Onderdonk, assignor to U. S. Industrial Alcohol Co.), a fuel gel made of alcohol and nitrocellulose has fine asbestos fiber dispersed throughout the gel to tame the nitrocellulose and provide even, uniform combustion at a moderate rate.

Dyes call for help

Many dyes are shy on affinity for textile fibers, as everybody knows who has ever washed cloth dyed with such a dye. But with well-chosen assistants fast dyeings are obtained with dyes which would otherwise fade out at the first touch of water, and even with dyes which refuse to color the fibers at all. Recent developments have brought out a number of synthetic resins which respond nobly when called in to halt the flight of fugitive dyes or to conscript dyes which decline to serve. These are described by J. Wakelin in *Canadian Textile Journal 56*, No. 2, 36–8, 48 (1939).

Clean air

Air filters having a fibrous filter medium sprayed with a dust-catching liquid are improved by using a cellulose ester or ether solution for dust retention, according to U. S. Patent 2,199,385 of May 7, 1940 (Shailer L. Bass, assignor to Dow Chemical Co.). The preferred solution is ethylcellulose with intrinsic viscosity up to 20 seconds at 25 deg. C at a concentration of 16 oz. per gal. in toluene alcohol (80:20), but similar solutions of benzylcellulose, cellulose acetate or cellulose acetate-butyrate may also be used.

Clean liquids

A very different type of filter is disclosed in British Patent 504,549 of April 26, 1939 (U. S. Rubber Products, Inc.). According to this invention filters with microscopically fine pores, capable of holding back the most finely divided solids and giving clear, sparkling filtrates can be made from artificial resins. To make such a microporous filter a thermosetting phenol-formaldehyde or urea-formaldehyde resin is compounded with a highly hydrous oxide gel and the resin compound is hardened without allowing the water in the gel to evaporate.

Plastics befriend rubber

Losses incurred when vulcanized rubber articles stick to the mold are avoided, and desirable gloss is imparted to the molded rubber goods, by using a cellulose ether solution as mold lubricant, according to U. S. Patent 2,201,271 of May 21, 1940 (Edward G. Partridge, assignor to B. F. Goodrich Co.). The cellulose ether may be methyl-, ethyl- or benzylcellulose.

Tough yet gentle oils

Polystyrene resins are tough, but they can be made tougher by reaction with products formed in cracking paraffin wax. The reaction products are polyalkyl styrenes which are not only tough themselves but are able to toughen lubricating oils, especially machine oils. A little of the resin increases the viscosity of the oil and gives it better film tenacity. The invention is disclosed in British Patent 509,823 of July 21, 1939 (I. G. Farb. Akt.).

Lubricant jellies

Hub grease, solidified oil for clocks and instruments, vacuum stopcock grease and other semisolid lubricants are obtained by blending ethylcellulose, cellulose stearate, cellulose acetate-stearate or the like with castor oil in such proportions as to form a jelly. The cost of such jellies can be lowered, without sacrificing performance, by incorporating a petroleum lubricating oil with the castor oil. These jellied lubricants are described in U. S. Patent 1,963,901 of June 19, 1934 (K. C. D. Hickman, assignor to Eastman Kodak Co.).

Paint that soon comes off

Polyvinyl alcohol serves better than oil or grease as a temporary film for protecting iron, steel, copper, brass, silverware and the like from corrosion or tarnishing while in transit or storage. The thin film of soluble resin gives effective temporary protection to cutlery, razor blades, instruments and other metal articles, and is easily removed when the metal is to be used. Several typical applications of the invention are described in U. S. Patent 2,162,618 of June 13, 1939 (Emmette F. Izard, assignor to E. I. du Pont de Nemours and Co., Inc.).

Ink just where you want it

A composition with high ink absorption capacity, for use instead of gelatin rolls in hectograph type duplicating machines, is made by emulsion polymerization of an acrylate or methacrylate ester. Sulphonated castor oil is employed as emulsifying agent. As set forth in U. S. Patent 2,153,324 of April 4, 1939 (Johan Bjorksten, assignor to Ditto, Inc.), the polyacrylate resin is applied to a fabric support to form a pad or roll on which impressions are made from an inked copy sheet.

Circuit breaker gas attack

In arc-extinguishing tubes for circuit breakers, designed to make an arc extinguish itself by generating gas from a thermally unstable material, cellulose hydrate has special merit as the gas source since it decomposes without carbonizing and so deposits no soot. U. S. Patent 2,188,806 of January 30, 1940 (Hermann

Burmeister, assignor to General Electric Co.), discloses such an arc-extinguishing tube in which cellulose hydrate is supported by a hardened tube of urea-formaldehyde resin.

Better vision by night

Polarized light has a variety of uses, one of the foremost being improved automobile headlighting without glare. The Polaroid Corp. has been active in developing laminated glass, goggle lenses and headlamp lenses containing a minutely crystalline polarizing substance such as herapathite dispersed in cellulose acetate or other plastic sheeting. Such products are covered, for example, by U. S. Patents 2,165,973 of July 11, 1939 and 2,168,220 and 2,168,221 of August 1, 1939 (Edwin H. Land, assignor to Polaroid Corp.). But in a later patent (2,173,304 of September 19, 1939) the same inventor reports his discovery that plastic polarizing sheets can be produced very inexpensively, without the aid of herapathite or any other polarizing crystals, by stretching a dry cast or extruded sheet of polyvinyl alcohol while hot until the resin itself acquires the power to polarize light.

Precision in optical instruments

Taking advantage of the excellent optical properties and the possibility of high precision ruling offered by polyacrylate resins, diffraction gratings for spectroscopic work are made by ruling the grating pattern on a die and molding the resin against the face of the die. This invention is described in British Patent 501,606 of March 2, 1939 (Frank Twyman, assignor to Adam Hilger, Ltd.).

Embalmed bugs and flowers

In imitation of amber, which has sometimes preserved insects for thousands of years, biology specimens are now preserved by embedding them in a highly transparent urea-formaldehyde resin. Clear visual examination of the embedded specimens is easy. The resin is made by a special acid condensation procedure in presence of a free or partially esterified or etherified polyhydric alcohol or sugar. This invention is covered by British Patent 507,175 of June 12, 1939 (I. G. Farb. Akt.).

Snaring caterpillars

An insect glue, especially for ringing trees to trap caterpillars, is disclosed in Russian Patent 53,568 of July 31, 1938 (N. V. Bogomolov, P. I. Astrakhantsev and P. A. Tsvetkov). It contains resin esters or chlorinated resinates to prevent thickening of the oil: wax mixture.

Capital punishment for insects

According to U. S. Patent 2,204,009 of June 11, 1940 (Herman A. Bruson, assignor to Röhm and Haas Co.), Alkyd resins made from Polyglycerol with phthalic, succinic, maleic or sebacic acid and modified with saturated or unsaturated fatty or hydroxyfatty acids (not drying oil acids) are toxic to insects and impart good wetting, spreading and sticking properties to insecticidal sprays. If the acid number of the resin is kept below 5 the product is harmless even to sensitive plants and can be used freely in sprays.

Resins in the wrong place

One instance of a resin synthesis where it is not wanted has been noted by automotive engineers investigating "engine varnish." Their observations, as reported to the Society of Automotive Engineers by F. F. Kishline and published in the Society's *Journal* (*45*, 321–4, 334T, 1939), show that lubricating oils form resinous film deposits on metal when exposed to heat, oxidation and probably also to catalytic effects of impurities or substances with which the lubricating oil comes in contact.

No hangover here

One of the foremost authorities on cellulose ethers was the late Dr. Leon Lilienfeld, who was an Austrian brain surgeon. He experimented with methylcellulose and ethylcellulose as preservatives for cut flowers, as textile assistants and for many other uses. Probably it was his medical skill which led him to the idea of adding cellulose ethers to alcoholic liquors to prevent inebriation of the drinker. Methyl- and ethylcellulose are harmless and have the physiological effect of lessening the amount of alcohol passing into the blood from the stomach. Moreover, such alcohol as does pass into the blood disappears much more quickly than in absence of the cellulose ether. The treatment is particularly applicable to whisky and wines but is beneficial also in beer. The amount of cellulose ether needed is ordinarily 10 to 25% of the actual alcohol content of the beverage. This invention is covered, among others, by U. S. Patents 2,113,596 of April 12, 1938, and 2,159,167, May 23, 1939 (Leon Lilienfeld).

Crab shell drinking straws

Crab and lobster shells, once a worthless cannery by-product, consist mainly of chitin, an animal analog of cellulose. According to U. S. Patents 2,168,374 and 2,168,375 of August 8, 1939 (Clifford J. B. Thor, assignor to Visking Corp.), flaked chitin can be dispersed in aqueous alkali and treated as cellulose is treated in making viscose. The product can be extruded in tubular form and regenerated to form chitin drinking straws, sausage casings and the like.

Something to masticate

Chicle, the natural chewing gum base, faces actual or potential competition from a number of sources. Among the latest is an olefin: diolefin resin, disclosed in U. S. Patent 2,197,240 of April 16, 1940 (G. A. Hatherell, assignor to F. A. Garbutt).

Delayed action pills

Pills which must pass through the stomach unchanged in order to exert needed medicinal effects in the

intestines require a coating which is insoluble in the acidic gastric juice but dissolves readily in the alkaline acting intestinal juice. Physicians call such coated pills "enteric pills." A recent invention, set forth in U. S. Patent 2,205,111 of June 18, 1940 (Ernest H. Volwiler and Marjorie B. Moore, assignors to Abbott Labs.), utilizes alkyd resins for enteric coatings which are much superior to the keratin, stearic acid and hardened gelatin coatings most commonly employed. The resin is modified either with a fatty acid or with a long chain alcohol to make it more soluble in organic mediums and less soluble in water. At the same time the modifier increases acid resistance so that the pill passes intact into the intestine.

Relief for tortured skin

Liquid or sticky medicinal agents for skin treatment are not easy to incorporate in dusting powders. But a powder which successfully serves as a carrier for tar, liquids or the like, yet retains its good dusting behavior is disclosed in U. S. Patent 2,185,178 of January 2, 1940 (Reinhard Beutner, assignor to Parke, Davis and Co.). A phenol-formaldehyde resin is melted, the liquid or sticky ingredient is added and the resin, after cooling, is ground to powder. It is nonhygroscopic, remains completely dry though acting as carrier for a liquid or semiliquid, and is itself an antiseptic with analgesic and vasoconstrictive effects.

The same inventor, in U. S. Patent 2,184,575 of December 26, 1939, utilizes a urea-modified phenol-formaldehyde resin to produce a drying ointment, i. e., an ointment which contains a volatile solvent and dries to a nontacky adherent film on the skin. Ointments containing a volatile solvent for this purpose are new to pharmacy.

Battling diphtheria

Diphtheria toxoid can be purified by adsorbing it on a nitrocellulose gel and removing the toxoid from the gel by elution in a slightly alkaline medium. For this process nitrocellulose is a better adsorbent than cellulose acetate. Just as a faintly alkaline medium favors elution of the adsorbed toxoid, so a faintly acid medium favors adsorption of the toxoid on nitrocellulose. Cooling also aids adsorption. This method of purifying diphtheria toxoid was reported by L. Reiner, *Journal of Immunology 24*, 221–7 (1933).

Bandits beware

Along the path from acrylic and methacrylic acids to the polyacrylate and polymethacrylate resins a potent tear gas has been discovered in the du Pont research laboratories. Chlorination of methyl, propyl or cyclohexyl methacrylate, or of methyl acrylate, yields products which are useful as plasticizers and also as modifiers for alkyl resins. Some of the chlorination products are active lachrymators which, though not actually gases, are effective ingredients in tear gas compositions. These products are disclosed in U. S. Patent 2,195,712 of April 2, 1940 (R. A. Jacobson, assignor to E. I. du Pont de Nemours and Co., Inc.).

Symphony at home

(*Continued from page 50*) originate as infinitesimally small oscillations of electrons in radio vacuum tubes, not as sound. These minute oscillations are then amplified with vacuum tubes and changed from electricity to sound with speakers.

The tones of the Solovox are voiced to supplement those of the piano. Whereas the tones of the piano are percussive and practically without vibrato, those of this new instrument are made sustained with smooth attack, and may be produced with a great degree of vibrato and its attendant tonal warmth. In melodic passages, the melody may be played on the instrument with piano accompaniment as written, to create the effect of two musicians playing—an instrumental soloist with piano accompaniment. To persons with but limited musical educations this device affords the opportunity to enhance and experiment with even simple piano music. The orchestral variety and organ effects possible add to the scope of home entertainment.

Credits: Invented by Laurens Hammond; production design by Geo. H. Stephens, Chief Engineer of the Hammond Instrument Co. Materials: Bakelite phenolic and Beetle; Molded by Kurz-Kasch, Incorporated.

Molecular weight and solubility of p-toluene sulfonamide resins

(*Continued from page 59*) at present we interpret the value of n as a result of the relative proportions of mono-, di-, and tri-molecular forms, this is not necessarily the case. For example, when $n = 2.56$, this may show a mixture of about equal quantities of $n = 2$ and $n = 3$, or it may show the effect of a quantity of $n = 1$ on some $n = 3$, or on some polymer higher than $n = 3$. Since we have no definite reason for choice of values, it may be that when $n = 2$ or 3 such may be the result of the proper proportions of $n = 1$ with higher polymers. It is proposed to study the effect on n of concentration of condensate and of time in order to answer this question more definitely

Solubility relationships show that three phases of the condensate separate from benzene below about 37.5 weight percent and that two phases (I or II and III) separate above this composition. Solution temperatures for II for concentrations below three percent and for I between concentrations of 25 and 35 percent were difficult to reproduce. The material crystallized from toluene gave especially peculiar results between 25 and 35 percent for form I. Solution temperatures in this region had to be observed quickly since the samples had a tendency to pass into III. The sample having weight percent of 25.18 completely dissolved at 43 deg. (I), crystallized out, dissolved completely again at 51 deg. (II), crystallized out again and dissolved completely at 81.2 deg. (III). The sample having weight percent 31.18 behaved similarly with solution temperatures of 50.5 deg. (I), 52 deg. (II), and 84.6

deg. (III). The last sample dissolved completely at 73.5 deg. After crystallization by sudden chilling, the sample dissolved completely at the same temperature. Extended cooling and reheating of this sample did not give III. No attempt has been made to identify these phases as yet. The data for curves in Fig. 1 is incomplete at low temperatures.

Summary

1. The results of molecular weight determinations on the crystallized paratoluene sulfonamide-formaldehyde condensate indicate that the crystalline material is not constant in composition in the various solvents and under various conditions. It acts as a varying mixture of different forms, indicating polymerization up to n = at least 3. It is proposed to study the effect of temperature and concentration as functions of time in order to ascertain whether or not constant values of n may be obtained.

2. The solubility data show that three phases separate from benzene and that they may be changed by conditions. The data do not yet establish whether they are polymeric or polymorphic forms of the condensate or solvated molecules.

Acknowledgment

We wish to express our gratitude to Dr. H. L. Bender for examining the data here presented and for his advice and many valuable suggestions concerning the preparation of this paper.

In the limelight

(*Continued from page 74*)

The late Carleton Ellis in his laboratory

● CARLETON ELLIS OF MONTCLAIR, NEW JERSEY, died in Miami Beach, Florida, on January 13th. Mr. Ellis held over 750 patents covering a wide range of subjects in varied fields. He was responsible for developments in many industries including petroleum, glass, cosmetic, paint and varnish and plastics. Perhaps no industry was more extensively affected by Mr. Ellis' activity than plastics. He made important contributions to many phases of synthetic organic molding compounds, and his 2 volumes on "The Chemistry of Synthetic Resins" have been a valuable addition to the literature on plastics. Best known in the industry for his work in urea-formaldehyde, he was granted U. S. patent No. 1,482,358, Jan. 29, 1924, which covered a casting and molding plastic with a urea-formaldehyde base. One of his outstanding contributions to these materials was his development of a latent catalyst for them. He was (*Please turn to next page*)

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➡ **WANTED—CHEMIST OR CHEMICAL ENGINEER experienced in production of molded resin bonded brake blocks, brake linings and friction materials. Give complete details as to experience, types of materials familiar with. Reply Box 418, Modern Plastics.**

➡ **FOR SALE: 1 #5 1/2 Colton Preform Machine, in excellent condition, reasonably priced. Reply Box 419, Modern Plastics.**

➡ **WANTED IMMEDIATELY: ONE W. & P. MIXER, size 15, type 6, class BB or C 100 gal. working capacity jacketed. Sigma Blades. ONE SCREW STRAINER 8″ or 10″ jacketed cylinder and water cooled worm. State make, prices, condition, full details. Reply Box 420, Modern Plastics.**

97 # 12/31-2V.

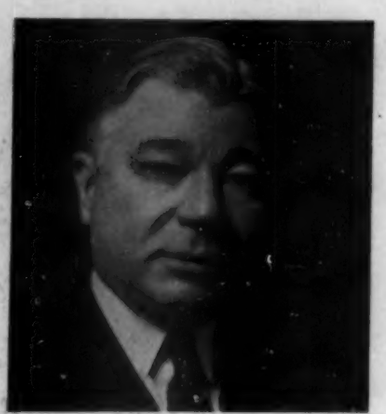
identified with the foundation of the Unyte Co. in 1931, which later merged with the Toledo Synthetic Products Co. in 1936 to become the Plaskon Company.

Mr. Ellis was responsible for important developments in alkyd resins which are important raw materials in paint and lacquer manufacturing. His first patent No. 1,541,336 covering alkyds was awarded Jan. 9, 1925. It was intended by coincidence, as described, to make molded articles of glycerol phthalate with asbestos as a filler. The Rezyl Corp., a subsidiary of American Cyanamid Co., was formed in 1928 to manufacture resins of this class under Ellis' patent. He also made contributions to phenolic plastics, his first patent on this class of resins was granted July 13, 1926. It covered a phenol-furfural development. In the same year he received a patent on the use of hexylmethylenetetramine in certain types of phenol-formaldehyde resins.

● THE SCHOOL OF DESIGN IN CHICAGO, 247-257 EAST Ontario Street, under the direction of L. Moholy-Nagy, announces the opening of its spring semester on February 3, for day and evening classes.

● IT HAS BEEN CALLED TO OUR ATTENTION THAT the following industrial designers were omitted from the Directory section of the 1941 MODERN PLASTICS CATALOG: Sydney Cassyd, 1 Maple St., East Rutherford, New Jersey; Dave Chapman, 540 N. Michigan Ave., and G. McStay Jackson, Inc., 840 N. Michigan Ave., Chicago. The J. M. Gordon Co., 189 Green St., and Czecho Peasant Art Co., 10 West 19th St., New York, Fabricators of sheet material should be added to that classification, and Raymond Laboratories, Inc., Plastics Div., St. Paul, Minn., included under Custom Molders, Compression. In the list of trade names the addresses of the following companies were incorrect: Celluloid Corp., 180 Madison Ave., New York; Parkwood Corp., 24 Water St., Wakefield, Mass.

●IT IS WITH REGRET THAT WE REPORT THE DEATH of George J. Crosman, founder and president of Compo-Site, Inc., Newark, N. J., who passed away on December 20. The firm which Mr. Crosman founded in 1911 was one of the earliest plastic molding companies.



● WILLIAM P. PICKHARDT (ABOVE) DIED ON JAN. 22, 1941, at the age of sixty at Lenox Hill Hospital, New York. Mr. Pickhardt, after his graduation from Columbia University in 1901, devoted his activities to the chemical business in the firm of Kutroff Pickhardt & Co. When, in 1931, the Unyte Corp. was formed for the purpose of manufacturing urea-formaldehyde materials, Mr. Pickhardt became its first president and continued in that office until July 1936 when Unyte was merged with Plaskon Co., Inc. At that time he became a director of Plaskon and maintained active association with that company until his death. Mr. Pickhardt was also a director of General Aniline & Film Corp. Magnesium Corp. of America, General Dyestuff Corp., and Synthetic Nitrogen Products Corporation.